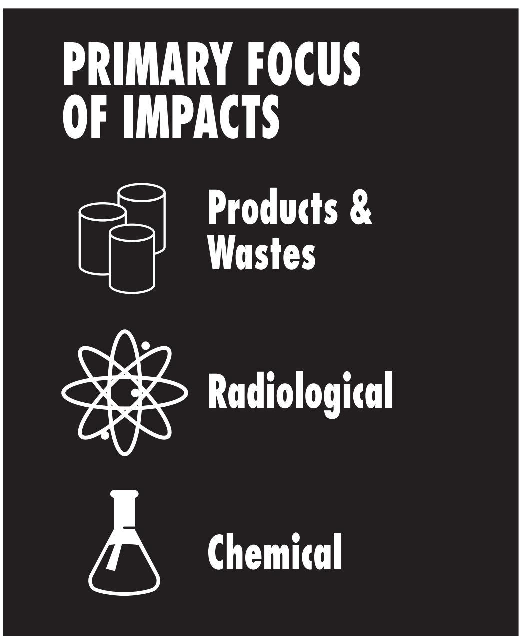
4.0 ENVIRONMENTAL CONSEQUENCES

Chapter 4 of this Summary Presents:

- *Overview of Methodology for Calculating Impacts*
- *Overview of Impacts*

Chapter 4 of this Summary presents an overview of the methodology used to evaluate environmental impacts and presents a summary of the environmental impacts associated with the No Action Alternative and the Action Alternatives. As described in Chapter 2, the alternatives evaluated for the 10 material categories (some with further subcategories) are as follows:

- The *No Action Alternative* is a set of processing options that prepare the Rocky Flats plutonium residues and scrub alloy for indefinite storage.
- The *Action Alternatives* consist of a set of technology options for processing of these materials so that they meet requirements for disposal or other disposition. (Several options were evaluated for each material category and subcategory.) The Proposed Action could be accomplished by either Alternatives 2, 3, or 4 (identified in Section 2.1 of this Summary) or by some combination of these alternatives for different material categories or portions of one or more material categories.
- The *Preferred Alternative* is a specific selection of preferred processing technologies from the list of processing technologies applicable to each material category and subcategory.



4.1 METHODOLOGY FOR EVALUATING AND PRESENTING ENVIRONMENTAL IMPACTS

Each material category and subcategory was analyzed independently. For each one, every combination of material and processing option specified in Chapter 2 of this Summary was analyzed. For each combination of material and processing option, a set of impacts was assessed, including:

- Amounts of products and wastes
- Radiological health effects due to:
  - Incident-free operations and transportation
  - Accidents
- Chemical health effects due to:
  - Incident-free operations and transportation
  - Accidents

DOE then calculated the total impacts of processing all the plutonium residues and scrub alloy under the No Action Alternative and for alternatives accomplishing the Proposed Action. DOE also calculated the range of potential impacts at each site from the processing technologies.

The focus of the impacts is on public and occupational health and safety associated with the processing technologies and any associated transportation. The following sections provide an overview of how the radiological and chemical health effects were calculated for members of the public and workers.

4.1.1 INCIDENT-FREE OPERATIONS AND ACCIDENT CONDITIONS

Radiological and chemical health effects were calculated for processing options under incident-free operations and accident conditions.

- For *incident-free operations*, the impacts are those that are anticipated to occur as a result of process operations and transportation over whatever time period is necessary to process the entire inventory of residues and scrub alloy covered under this EIS.

- For *accident conditions*, DOE analyzed a wide spectrum of potential accident scenarios, including fire, explosion, spill, criticality, earthquake, and aircraft crash. Accident scenarios with the highest consequences and risks are used in the EIS for the purpose of bounding consequences and identifying the largest contributor to total risk. The risks associated with accidents for each processing option with each residue and scrub alloy category were also computed.

The methods used for calculating the consequences from incident-free operations and accident conditions are described in the sections that follow.

4.1.2 CALCULATING RADIOLOGICAL HEALTH EFFECTS

For each material type and processing option, radiological health effects are presented in terms of the potential radiation *dose* that a person or population would receive (based on standard computer codes used for estimating doses from releases). A risk factor is applied to the estimated dose to a *maximally exposed individual* (a worker or a member of the offsite public) to derive a *probability of a latent cancer fatality*. For the potentially exposed population (workers and the offsite public), the dose received by the receptor group is converted to the *number of estimated excess latent cancer fatalities*.

Estimated doses from incident-free operations are based on anticipated releases and direct exposures. Estimated doses from accident conditions take into account the estimated frequency of the accident, the duration of the process, and the magnitude of any potential release.

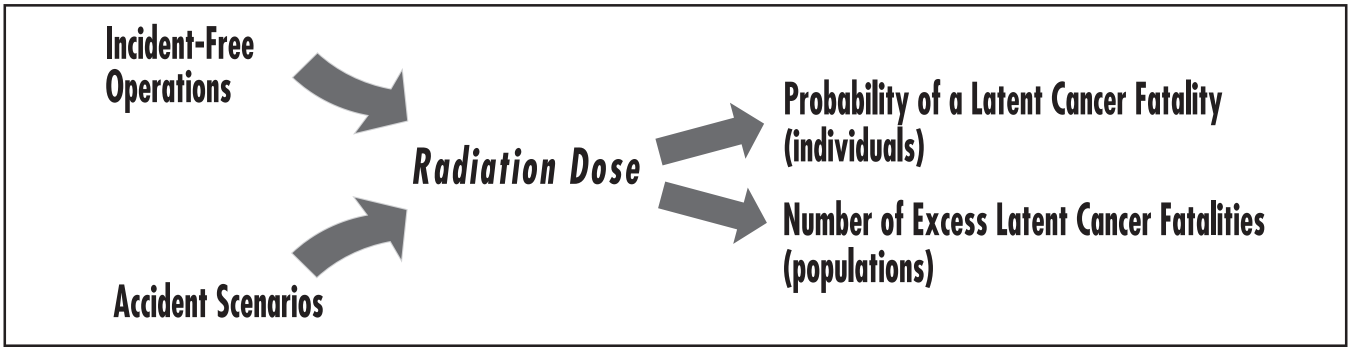
Health effects associated with these doses are presented for the *maximally exposed individual* (worker and member of the public), the *worker population*, the *offsite public population* living within a radius of 80 kilometers (50 miles) from the site, and the public population living and traveling along transportation routes.

For those processing options that involve transportation from Rocky Flats to the Savannah River Site and Los Alamos National Laboratory, the estimated doses and associated health effects from transportation are factored into the results for those processes. DOE uses the RADTRAN code to determine the doses potentially received by populations.

4.1.3 CALCULATING CHEMICAL HEALTH EFFECTS

The potential impacts of exposure to hazardous chemicals released to the atmosphere as a result of the processing of plutonium residues and scrub alloy were evaluated for the routine operation of processing facilities.

Impacts for incident-free operation are presented for the maximally exposed individual worker, the maximally exposed offsite member of the public, the offsite population in an 80-kilometer (50-mile) radius, and the worker



The Maximally Exposed Individual

The maximally exposed individual is an individual who receives the highest dose in a given situation. For incident-free processing operations, the dose is calculated for the hypothetical individual (member of the public) who resides at the site boundary in a downwind direction. For incident-free transportation, the dose is calculated for a hypothetical individual stuck in traffic next to a shipment for 30 minutes. The maximally exposed worker during incident-free operations is assumed to receive an annual dose equal to the DOE Administrative Control Level. Under accident conditions, the dose is calculated for the individual worker located 100 meters (328 feet) or more downwind from the release point when an accidental release of radioactive material occurs. The dose is also calculated for a hypothetical member of the public located at the site boundary downwind from the release point when an accidental release of radioactive material occurs.

Population Within 50 Miles

For both incident-free processing operations and accident conditions, doses (and associated health effects) are determined for the general populations that reside within an 80-kilometer (50 mile) radius of each of the three candidate sites. Several types of data are used in the assessment of these values, namely: meteorological data, agricultural production and consumption data, and demographic data. Meteorological data assist in the calculation of doses to populations that are downwind from a release; agricultural data help determine the doses that people receive by the amount of contaminated food they eat; demographic data help define how many people are situated at a given distance and direction, relative to a release location.

Conservatism in Estimating Health Effects

This EIS uses a conservative approach in estimating health effects to individuals and populations. Estimates are based on the linear no-threshold theory of radiation carcinogenesis, which postulates that all radiation doses, even those close to zero, are harmful. It is stated in a recent report issued by the National Council of Radiation Protection and Measurements that there is no proof or direct support for this theory. DOE uses the conservative approach to provide an upper bound on the potential health effects.

Accident Risk

Under the realm of accident conditions, for each applicable scenario type (e.g., fire, explosion) a radiological "risk" is determined for the maximally exposed offsite individual, general population within 80 kilometers (50 miles), and onsite noninvolved worker. This risk is attained by multiplying a scenario's probability of occurrence by its associated consequences. For example, if a given accident has a one-in-a-one-million (10^{-6}) probability of occurrence per year and its consequence is 10 rem to the maximally exposed offsite individual, then the total annual risk to this individual is [(10^{-6}/yr)(10 rem)], which is equal to 10^{-5} rem/yr. Associated health effects (i.e., latent fatal cancer risks) are then determined by the application of risk factors discussed in Appendix D of this final EIS.

population. Health effects evaluated include excess incidences of latent cancers and potential for chemical-specific noncancer health effects.

Accident analyses for hazardous chemicals were not conducted for this EIS. However, chemical accident analyses have been conducted in other safety analyses and NEPA analyses for Rocky Flats, the Savannah River Site, and Los Alamos National Laboratory (see Section 4.1.3 of the Final EIS). These analyses are relevant to the proposed action because they address similar types of facilities using similar types of chemicals and are, therefore, incorporated by reference. As discussed more fully in Section 4.1.3 of the Final EIS, prior analyses estimate that the chemical accident risks for the offsite public and onsite workers not involved in the facility processes would be low and could be limited by emergency response actions. Workers involved in the facility processes, however, could experience serious injury or fatalities due to their closeness to the source of the accident. Only very severe accidents, that are not likey to occur, could cause such severe impacts.

4.1.4 Plutonium and Americium Toxicity

The adverse health effects experienced following exposure to plutonium result predominantly from its radiological toxicity rather than its chemical toxicity. Plutonium is not readily absorbed from the gastrointestinal tract following ingestion or through the intact skin following dermal exposure; inhalation is the most common route of human exposure. Once inhaled, the rate of clearance from the lungs is influenced by particle size, specific isotope, and chemical form. Following inhalation exposure, plutonium partitions to the lungs, liver, and bone. The radiotoxicity of plutonium results from its emissions of ionizing radiation, primarily in the form of alpha particles, although low-energy gamma radiation and low-energy neutrons are also released. In studies with laboratory animals, exposure to high radiation doses of plutonium isotopes has resulted in decreases in lifespans, diseases of the respiratory tract, and cancer. Plutonium residues and scrub alloy contain a number of different isotopes of plutonium.

In addition to plutonium isotopes, scrub alloy and some plutonium residues contain substantial amounts of americium-241, which is formed by the decay of plutonium-241. Americium-241 is radiotoxic because it produces high gamma radiation doses and also emits alpha particles and neutrons. Like plutonium, the radiotoxicity of americium is of much greater concern than its chemical toxicity.

4.2 SUMMARY OF IMPACTS

This section summarizes the impacts associated with the processing options evaluated in this EIS. The following subsections cover:

- Comparison of Health and Safety Risks with Common Risks to the Public
- Impacts of the Strategic Management Approaches
- Range of Impacts at Each Site
- Range of Intersite Transportation Impacts
- Environmental Justice
- Cumulative Impacts

Radiation dose is expressed in terms of rem or millirem. One rem is 1,000 millirem. One millirem may also be expressed as 0.001 rem. The average individual in the United States receives a dose of about 300 millirem per year (or 0.3 rem per year) from natural background radiation. Millirem is abbreviated as "mrem."

4.2.1 COMPARISON OF HEALTH AND SAFETY RISKS WITH COMMON RISKS TO THE PUBLIC

This section compares the increased risks to the public associated with the management of plutonium residues and scrub alloy to those of common activities, such as smoking, flying, receiving a medical x-ray, and so forth.

- ***Risks in the Proposed Action*** — Below are highlights of the highest risks from any combination of processing activities evaluated in the EIS.

  The highest increase in the incident-free population risk to the general public living near any of the DOE management sites due to radiation exposure would be 0.00019 latent cancer fatalities. This risk occurs at the Savannah River Site. The risk would be spread among the 755,000 people who are expected to live within 80 kilometers (50 miles) of the site when processing would take place. The risk of a latent cancer fatality to the maximally exposed individual in this population would be increased by less than one chance in one hundred million ($1.7x10^{-9}$).

  The highest increase in the accident population risk to the general public living near any of the DOE management sites would be 0.66 latent cancer fatalities. This risk occurs at the Rocky Flats site. The risk would be spread among the 2.4 million people who are expected to live within 80 kilometers (50 miles) of the site when processing would take place. The risk of a latent cancer fatality to the maximally exposed individual in this population would be increased by less than one chance in ten thousand (0.000042).

  The highest increase in the population risk to the general public along any of the transportation routes due to radiation exposure during ground transport would be 0.010 latent cancer fatalities, if the maximum number of shipments is assumed (208 from Rocky Flats to the Savannah River Site). The risk from radiation exposure to the maximally exposed individual along any transportation route would be increased by less than one chance in one hundred thousand ($5.5x10^{-6}$).

  Nonradiological fatalities are also unlikely. The highest increases in the risk of nonradiological fatalities to the public is through a traffic accident involving a truck transporting plutonium residues or scrub alloy. Assuming the same number of shipments (208 to the Savannah River Site), the increase in the population risk to the general public along the transportation routes would be 0.021 fatalities.

- ***Risks from Common Activities*** — Every activity carries some risk. Table S-6 shows activities estimated to increase an individual's chance of death in any year by one in one million. Most of these activities would not be considered unusually risky actions, and they can be compared to the risks presented in this chapter for perspective only.

4.2.2 IMPACTS OF THE STRATEGIC MANAGEMENT APPROACHES

Selection of the future steps to be taken in the management of the plutonium residues and scrub alloy must be made separately for each material category and subcategory since chemical and physical differences between the material categories require that each category be handled using different methods, and possibly different management sites. Nevertheless, in an attempt to simplify presentation of this large group of processing options, DOE has assembled the separate processing options for the individual material categories into eight groups that allow the impacts of processing the plutonium residues and scrub alloy to be compared.

Table S-6. Risks Estimated to Increase Chance of Death in Any Year by One Chance in a Million

Activity	Cause of Death
Smoking 1.4 cigarettes	Cancer; heart disease
Living 2 days in New York or Boston	Air pollution
Traveling 16 km (10 mi) by bicycle	Accident
Flying 1,600 km (1,000 mi) by jet	Accident
Living 2 months in Denver on vacation from New York	Cancer caused by cosmic radiation
One chest x-ray	Cancer caused by radiation

These groupings of processing options are referred to as Strategic Management Approaches. They include the No Action Alternative and the Preferred Alternative discussed previously. They also include six illustrative groupings of processing options that would have the following overall effects:

- Minimization of Process Duration at Rocky Flats
- Minimization of the Cost
- All Actions Taken at Rocky Flats
- Conduct Fewest Actions at Rocky Flats
- Process with Maximum Separation of Plutonium
- Process with No Separation of Plutonium

The Strategic Management Approaches and the groupings of processing options that comprise them are shown in Table S-7.

The impacts of these various management approaches are compared in Section 4.2.2.1 of this Summary. It should be recognized that the Strategic Management Approaches, other than No Action and the Preferred Alternative, are illustrative cases generated to assist the public in understanding the relative impacts that could occur from various methods of managing the plutonium residues and scrub alloy. However, the material category-specific processing options that make up the illustrative Strategic Management Approaches do not necessarily represent optimum ways in which to manage the individual material categories.

Table S-7. Strategic Management Approaches for Processing Rocky Flats Plutonium Residues and Scrub Alloy

	MANAGEMENT APPROACHES							
Material Category	*No Action*	*Preferred Alternative*	*Minimize Total Process Duration at Rocky Flats* [a]	*Minimize Cost*	*Conduct All Processes at Rocky Flats*	*Conduct Fewest Actions at Rocky Flats*[b]	*Process With Maximum Plutonium Separation*	*Process Without Plutonium Separation*
Incinerator Ash Residues	Calcination/ Cementation at Rocky Flats (Alternative 1)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Preprocess at Rocky Flats and MEO at SRS (Alternative 3)	Repackage at Rocky Flats (Alternative 4)
Sand, Slag, and Crucible Ash Residues	Calcination/ Cementation at Rocky Flats (Alternative 1)	Preprocess at Rocky Flats and Purex at SRS (Alternative 3)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Preprocess at Rocky Flats and Purex at SRS (Alternative 3)	Preprocess at Rocky Flats and Purex at SRS (Alternative 3)	Repackage at Rocky Flats (Alternative 4)
Graphite Fines Ash Residues	Calcination/ Cementation at Rocky Flats (Alternative 1)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Preprocess at Rocky Flats and MEO at SRS (Alternative 3)	Repackage at Rocky Flats (Alternative 4)
Inorganic Ash Residues	Calcination/ Cementation at Rocky Flats (Alternative 1)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)[c]	Repackage at Rocky Flats (Alternative 4)
Molten Salt Extraction/ Electrorefining Salt Residues (IDC 409 only)	Pyro-oxidation at Rocky Flats (Alternative 1)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Salt Distill at Rocky Flats (Alternative 3)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Preprocess at Rocky Flats and Salt Distill at LANL (Alternative 3)	Repackage at Rocky Flats (Alternative 4)
Molten Salt Extraction/ Electrorefining Salt Residues (All Others)	Pyro-oxidation at Rocky Flats (Alternative 1)	Repackage at Rocky Flats (Alternative 4)	Salt Scrub at Rocky Flats and Purex at SRS (Alternative 3)	Salt Distill at Rocky Flats (Alternative 3)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Salt Distill at Rocky Flats (Alternative 3)	Repackage at Rocky Flats (Alternative 4)
Direct Oxide Reduction Salt Residues (IDCs 365, 413, 417, and 427)	Pyro-oxidation at Rocky Flats (Alternative 1)	Preprocess at Rocky Flats and Acid Dissolution/ Plutonium Oxide Recovery at LANL (Alternative 3) and Repackage at Rocky Flats (Alternative 4)[d]	Preprocess at Rocky Flats and Acid Dissolution/Plutonium Oxide Recovery at LANL (Alternative 3)	Salt Scrub at Rocky Flats and Purex at SRS (Alternative 3)	Repackage at Rocky Flats (Alternative 4)	Preprocess at Rocky Flats and Acid Dissolution/Plutonium Oxide Recovery at LANL (Alternative 3)	Preprocess at Rocky Flats and Acid Dissolution/Plutonium Oxide Recovery at LANL (Alternative 3)	Repackage at Rocky Flats (Alternative 4)
Direct Oxide Reduction Salt Residues (All Others)	Pyro-oxidation at Rocky Flats (Alternative 1)	Repackage at Rocky Flats (Alternative 4)	Preprocess at Rocky Flats and Acid Dissolution/Plutonium Oxide Recovery at LANL (Alternative 3)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Preprocess at Rocky Flats and Water Leach at LANL (Alternative 3)	Repackage at Rocky Flats (Alternative 4)
Aqueous-Contaminated Combustible Residues	Neutralize/Dry at Rocky Flats (Alternative 1)	Neutralize/Dry at Rocky Flats (Alternative 4)	Blend Down at Rocky Flats (Alternative 2)	Blend Down at Rocky Flats (Alternative 2)	Neutralize/Dry at Rocky Flats (Alternative 4)	Neutralize/Dry at Rocky Flats (Alternative 4)	MEO at Rocky Flats (Alternative 3)	Neutralize/Dry at Rocky Flats (Alternative 4)
Organic-Contaminated Combustible Residues	Thermal Desorption/ Steam Passivation at Rocky Flats (Alternative 1)	Thermal Desorption/ Steam Passivation at Rocky Flats (Alternative 4)	Blend Down at Rocky Flats (Alternative 2)	Blend Down at Rocky Flats (Alternative 2)	Thermal Desorption/ Steam Passivation at Rocky Flats (Alternative 4)	Thermal Desorption/ Steam Passivation at Rocky Flats (Alternative 4)	MEO at Rocky Flats (Alternative 3)	Thermal Desorption/ Steam Passivation at Rocky Flats (Alternative 4)
Dry Combustible Residues	Repackage at Rocky Flats (Alternative 1)	Repackage at Rocky Flats (Alternative 4)	Blend Down at Rocky Flats (Alternative 2)	Blend Down at Rocky Flats (Alternative 2)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	MEO at Rocky Flats (Alternative 3)	Repackage at Rocky Flats (Alternative 4)

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Table S-7 (continued). Strategic Management Approaches for Processing Rocky Flats Plutonium Residues and Scrub Alloy

	MANAGEMENT APPROACHES							
Material Category	*No Action*	*Preferred Alternative*	*Minimize Total Process Duration at Rocky Flats* [a]	*Minimize Cost*	*Conduct All Processes at Rocky Flats*	*Conduct Fewest Actions at Rocky Flats*[b]	*Process With Maximum Plutonium Separation*	*Process Without Plutonium Separation*
Plutonium Fluoride Residues	Acid Dissolution/ Plutonium Oxide Recovery at Rocky Flats (Alternative 1)	Preprocess at Rocky Flats and Purex at SRS (Alternative 3)	Preprocess at Rocky Flats and Purex at SRS (Alternative 3)	Preprocess at Rocky Flats and Purex at SRS (Alternative 3)	Acid Dissolution/ Plutonium Oxide Recovery at Rocky Flats (Alternative 3)	Preprocess at Rocky Flats and Purex at SRS (Alternative 3)	Preprocess at Rocky Flats and Purex at SRS (Alternative 3)	Blend Down at Rocky Flats (Alternative 2)
Ful Flo Filter Media Residues (IDC 331)	Neutralize/Dry at Rocky Flats (Alternative 1)	Blend Down at Rocky Flats (Alternative 2)	Blend Down at Rocky Flats (Alternative 2)	Blend Down at Rocky Flats (Alternative 2)	Blend Down at Rocky Flats (Alternative 2)	Blend Down at Rocky Flats (Alternative 2)	MEO at Rocky Flats (Alternative 3)	Blend Down at Rocky Flats (Alternative 2)
HEPA Filter Media Residues (IDC 338 only)	Neutralize/Dry at Rocky Flats (Alternative 1)	Neutralize/Dry at Rocky Flats (Alternative 4)	Vitrify at Rocky Flats (Alternative 2)	Blend Down at Rocky Flats (Alternative 2)	Neutralize/Dry at Rocky Flats (Alternative 4)	Neutralize/Dry at Rocky Flats (Alternative 4)	MEO at Rocky Flats (Alternative 3)	Neutralize/Dry at Rocky Flats (Alternative 4)
HEPA Filter Media Residues (All Others)	Neutralize/Dry at Rocky Flats (Alternative 1)	Repackage at Rocky Flats (Alternative 4)	Vitrify at Rocky Flats (Alternative 2)	Vitrify at Rocky Flats (Alternative 2)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	MEO at Rocky Flats (Alternative 3)	Repackage at Rocky Flats (Alternative 4)
Sludge Residues (IDCs 089, 099 and 332)	Filter/Dry at Rocky Flats (Alternative 1)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Vitrify at Rocky Flats (Alternative 2)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)[c]	Repackage at Rocky Flats (Alternative 4)
Sludge Residues (All Others)	Filter/Dry at Rocky Flats (Alternative 1)	Filter/Dry at Rocky Flats (Alternative 4)	Blend Down at Rocky Flats (Alternative 2)	Blend Down at Rocky Flats (Alternative 2)	Filter/Dry at Rocky Flats (Alternative 4)	Filter/Dry at Rocky Flats (Alternative 4)	Acid Dissolution/ Plutonium Oxide Recovery at Rocky Flats (Alternative 4)	Filter/Dry at Rocky Flats (Alternative 4)
Glass Residues	Neutralize/Dry at Rocky Flats (Alternative 1)	Neutralize/Dry at Rocky Flats (Alternative 4)	Vitrify at Rocky Flats (Alternative 2)	Neutralize/Dry at Rocky Flats (Alternative 4)	Neutralize/Dry at Rocky Flats (Alternative 4)	Neutralize/Dry at Rocky Flats (Alternative 4)	MEO at Rocky Flats (Alternative 3)	Neutralize/Dry at Rocky Flats (Alternative 4)
Graphite Residues	Repackage at Rocky Flats (Alternative 1)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Preprocess at Rocky Flats and MEO at SRS (Alternative 3)	Repackage at Rocky Flats (Alternative 4)
Inorganic Residues	Repackage at Rocky Flats (Alternative 1)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Repackage at Rocky Flats (Alternative 4)	Preprocess at Rocky Flats and MEO at SRS (Alternative 3)	Repackage at Rocky Flats (Alternative 4)
Scrub Alloy	Repackage at Rocky Flats (Alternative 1)	Preprocess at Rocky Flats and Purex at SRS (Alternative 3)	Preprocess at Rocky Flats and Purex at SRS (Alternative 3)	Preprocess at Rocky Flats and Purex at SRS (Alternative 3)	Calcine and Vitrify at Rocky Flats (Alternative 2)[e]	Preprocess at Rocky Flats and Purex at SRS (Alternative 3)	Preprocess at Rocky Flats and Purex at SRS (Alternative 3)	Calcine/ Vitrify at Rocky Flats (Alternative 2)[f]

[a] *Minimum time to process residues and scrub alloy at Rocky Flats for shipment to Savannah River Site, Los Alamos National Laboratory, or WIPP.*
[b] *Repackaging for some of the materials would result in fewer actions at Rocky Flats than would processing at SRS or LANL. This is the result of necessary preprocessing operations that would have to be performed at Rocky Flats prior to transport to SRS or LANL.*
[c] *No process with plutonium separation is available.*
[d] *There are two preferred processing technologies for the high plutonium concentration DOR salts. The rationale for having two preferred processing technologies is given in Section 2.5 of this Summary.*
[e] *Calcination/vitrification is the only processing technology for scrub alloy analyzed at Rocky Flats.*
[f] *Calcination/vitrification is the only processing technology without plutonium separation analyzed for scrub alloy.*

HEPA = High-efficiency particulate air
IDC = Item description code (for residue designation)
LANL = Los Alamos National Laboratory
MEO = Mediated electrochemical oxidation
SRS = Savannah River Site

4.2.2.1 COMPARISON OF THE STRATEGIC MANAGEMENT APPROACHES

The primary impacts of the eight management approaches are presented in Table S-8. These impacts have been derived by summing the impacts for each material category.

Table S-8. Comparison of Certain Impacts of the Strategic Management Approaches

Impact	MANAGEMENT APPROACHES							
	No Action	*Preferred Alternative*	*Minimize Total Process Duration at Rocky Flats*	*Minimize Cost*	*Conduct all Processes at Rocky Flats*	*Conduct Fewest Actions at Rocky Flats*	*Process with Maximum Plutonium Separation*	*Process without Plutonium Separation*
Products and Wastes								
Stabilized Residues (drums)[a]	20,300	**18,400**	8,900	7,800	19,200	17,600	700	19,200
Transuranic Waste (drums)[b]	3,500	**3,200**	6,600	3,400	5,600	3,200	9,300	9,200
High-Level Waste (canisters)	0	**5**	2	1	0	5	42	0
Separated Plutonium (kg)[c]	0	**607**	1,082	1,279	141	607	2,709	0
Low-Level Waste (drums)	7,500	**6,400**	10,400	4,900	5,500	6,400	19,900	4,800
Public and Occupational Health and Safety								
Incident-Free Radiological Risk to the Public Maximally Exposed Individual (Probability of a Latent Cancer Fatality)	2.4×10^{-10}	$\mathbf{5.5 \times 10^{-6}}$	5.5×10^{-6}	5.5×10^{-6}	1.2×10^{-10}	5.5×10^{-6}	5.5×10^{-6}	9.4×10^{-11}
Incident-Free Radiological Risk to the Public Population (Latent Cancer Fatalities)	6.0×10^{-6}	**0.0020**	0.0016	0.00083	4.0×10^{-6}	0.0020	0.0079	3.5×10^{-6}
Incident-Free Radiological Risk to the Maximally Exposed Individual Involved Worker (Probability of a Latent Cancer Fatality per Year)	0.00080	**0.00080**	0.00080	0.00080	0.00080	0.00080	0.00080	0.00080
Incident-Free Radiological Risk to the Involved Worker Population (Latent Cancer Fatalities)	0.48	**0.27**	0.25	0.24	0.28	0.27	0.34	0.40
Incident-Free Chemical Risk to an Individual Member of the Public (Probability of a Latent Cancer)	6×10^{-11}	$\mathbf{6 \times 10^{-11}}$	0	0	6×10^{-11}	6×10^{-11}	0	6×10^{-11}
Incident-Free Hazard Index (Individual Member of the Public)	0	$\mathbf{5 \times 10^{-9}}$	4×10^{-9}	3×10^{-9}	0	5×10^{-9}	1×10^{-8}	0
Incident-Free Chemical Risk to the Public Population (Number of Cancers)	<1	**<1**	<1	<1	<1	<1	<1	<1

Continued on next page.

Table S-8 (continued). Comparison of Certain Impacts of the Strategic Management Approaches

	MANAGEMENT APPROACHES							
Impact	*No Action*	*Preferred Alternative*	*Minimize Total Process Duration at Rocky Flats*	*Minimize Cost*	*Conduct all Processes at Rocky Flats*	*Conduct Fewest Actions at Rocky Flats*	*Process with Maximum Plutonium Separation*	*Process without Plutonium Separation*
Other Impacts								
Incident-Free Chemical Risk to an Individual Noninvolved Worker (Probability of a Latent Cancer)	3×10^{-9}	**3×10^{-9}**	0	0	3×10^{-9}	3×10^{-9}	0	3×10^{-9}
Incident-Free Hazard Index (Individual Worker)	0	**6×10^{-8}**	5×10^{-8}	4×10^{-8}	0	6×10^{-8}	1×10^{-7}	0
Incident-Free Chemical Risk to the Noninvolved Worker Population (Number of Cancers)	<1	**<1**	<1	<1	<1	<1	<1	<1
Accident Risk to the Public Maximally Exposed Individual (Probability of a Latent Cancer Fatality)	0.000035	**0.000038**	0.000032	0.000035	0.000036	0.000038	0.000046	0.000036
Accident Risk to the Public Population (Latent Cancer or Traffic Fatalities)	0.62	**0.64**	0.53	0.62	0.64	0.64	0.67	0.65
Accident Risk to the Onsite Noninvolved Worker (Probability of a Latent Cancer Fatality)	0.00061	**0.00070**	0.00062	0.00065	0.00067	0.00070	0.00085	0.00067
Intersite Round-Trip Transportation (1,000 km)[d]	0	**208**	166	84	0	208	823	0
Cost (millions $)[e,f]	1,129[g,h]	**524[i]**	482[i]	428[i]	510[h]	668[h]	814[j]	539[i]
Processing Duration at Rocky Flats (years)[k]	7.2	**5.5[l,m]**	2.6[l,n]	3.2[l]	5.1	2.8[l,o]	3.4[l,n]	10.2
Proliferation Risk	See Note p	**See Note q**	See Note q	See Note q	See Note q	See Note q	See Note q	See Note q
Air Quality Impacts[r]	No exceedances of air quality standards	**No exceedances of air quality standards**	No exceedances of air quality standards	No exceedances of air quality standards	No exceedances of air quality standards	No exceedances of air quality standards	No exceedances of air quality standards	No exceedances of air quality standards

Note: kg = kilograms; km = kilometers

[a] *All the stabilized residues, except those generated under the No Action Alternative, are transuranic wastes that would go to WIPP.*

[b] *Includes secondary waste generated during the processing of residues and scrub alloy such as contaminated gloves and equipment.*

[c] *To convert to pounds, multiply by 2.205.*

[d] *To convert thousands of kilometers to thousands of miles, multiply by 0.62.*

[e] *Decisional costs for labor, site overheads, itemized equipment, residue and waste processing, waste shipment and disposal, and fissile materials disposition, plus non-decisional costs for facilities upgrades, equipment, operational readiness reviews, start-up testing, and technology and development work. Excludes adjustments for technical or schedule uncertainties.*

[f] *Undiscounted 1997 dollars.*

[g] *Includes $460 million for 20 years of interim storage at Rocky Flats.*

[h] *Includes $220 million for facilities upgrades, equipment, operational readiness reviews, start-up testing, and technology and development work that is allocable to the clean-up of plutonium residues at Rocky Flats.*

[i] *Includes $190 million for facilities upgrades, equipment, operational readiness reviews, start-up testing, and technology and development work that is allocable to the clean-up of plutonium residues at Rocky Flats.*

[j] *Includes $250 million for facilities upgrades, equipment, operational readiness reviews, start-up testing, and technology and development work that is allocable to the clean-up of plutonium residues at Rocky Flats.*

[k] *Sum of durations for processing options with the shortest individual processing time at Rocky Flats. All processes at different buildings or modules at Rocky Flats are conducted concurrently. The sum of the shortest individual processing times does not necessarily equal the shortest processing time at the site since longer duration processing options at one facility may shorten the total duration at the site. Processing duration does not reflect technical or schedule uncertainties, deferred start-up due to technology demonstration and testing, or schedule interactions among processing options, facilities, or sites.*

[l] *Includes processing at the Savannah River Site F-Canyon. Processing durations at the Savannah River Site depend on schedules for materials in programs outside the scope of this EIS.*

[m] *Processing duration at Los Alamos National Laboratory is about four months.*

[n] *Processing duration at Los Alamos National Laboratory is about six months.*

[o] *Processing duration at Los Alamos National Laboratory depends on the type of new salt distillation equipment and the timing of its installation. The duration therefore depends on schedules for materials in programs outside the scope of this EIS.*

[p] *The plutonium residues and scrub alloy would be left in a form that cannot be disposed of due to proliferation concerns.*

[q] *The plutonium residues and scrub alloy would be managed and placed in a form that can be disposed of in a manner that supports United States nuclear weapons nonproliferation policy.*

[r] *All concentrations of pollutants in air are below Federal and State air quality standards. See Sections 4.12 and 4.25 of the EIS for additional information.*

4.2.2.1.1 PRODUCTS AND WASTES

The amounts of primary solid plutonium-bearing products and wastes that would be generated under the Strategic Management Approaches are compared in Figures S-18, S-19, S-20, S-21, and S-22.

For each Strategic Management Approach, except for No Action, the quantity of waste that could be sent to WIPP for disposal as transuranic waste is the sum of the quantities of drums shown in Figures S-18 and S-19. Under the Preferred Alternative, DOE would generate about 21,600 drums of processed residues and secondary waste that would be sent to WIPP for disposal. Under the No Action alternative, no processed residues would be disposed of.

The processed residues and secondary transuranic wastes that would be generated under the alternatives in this EIS are broken down into the two groupings shown in Figures S-18 and S-19 to distinguish between processed materials that would be below the safeguards termination limits and could thus be sent to WIPP, and those materials that would be above the safeguards termination limits and could only be sent to WIPP under a variance to safeguards termination limits:

- The term "Stabilized Residues," as used in the title of Figure S-18, is used to refer to processed materials that would still be above the safeguards termination limits even after processing under the action alternatives. The "stabilized residues" produced under the No Action alternative would be stored onsite and would not be sent to WIPP for disposal because their plutonium content would exceed the safeguards termination limits. The other "stabilized residues" that could be produced under this EIS would result from Alternative 4 and would be subject to a variance. As a result, they could be disposed of in WIPP.

- The term "Transuranic Waste," as used in the title of Figure S-19, is used to refer to those materials that would be below the safeguards termination limits after processing under the alternatives of this EIS. It includes both the processed residues and secondary transuranic waste that would be produced during the processing operation.

To reiterate, for the action alternatives of this EIS, the quantities in Figures S-18 and S-19 must be summed to determine the amount of transuranic waste that could be sent to WIPP.

Figure S-20 shows the amounts of plutonium that could be separated from the plutonium residues and scrub alloy. Two of the management approaches (No Action and Process without Plutonium Separation) do not involve any plutonium separation. Under the Preferred Alternative, DOE would separate roughly one-quarter of the plutonium that could be separated under the Maximum Plutonium Separation Management Approach. If any plutonium is separated, it would be placed in safe, secure storage until DOE makes decisions on its disposal or other disposition. DOE would not use this plutonium for nuclear explosive purposes.

The amounts of material to be managed as high-level waste and of low-level radioactive wastes that would be generated under each management approach are shown in Figures S-21 and S-22. The Process with Maximum Plutonium Separation Management Approach would generate the most material to be managed as high-level waste and also the most low-level waste. The Preferred Alternative would generate significantly smaller quantities of these wastes than this approach.

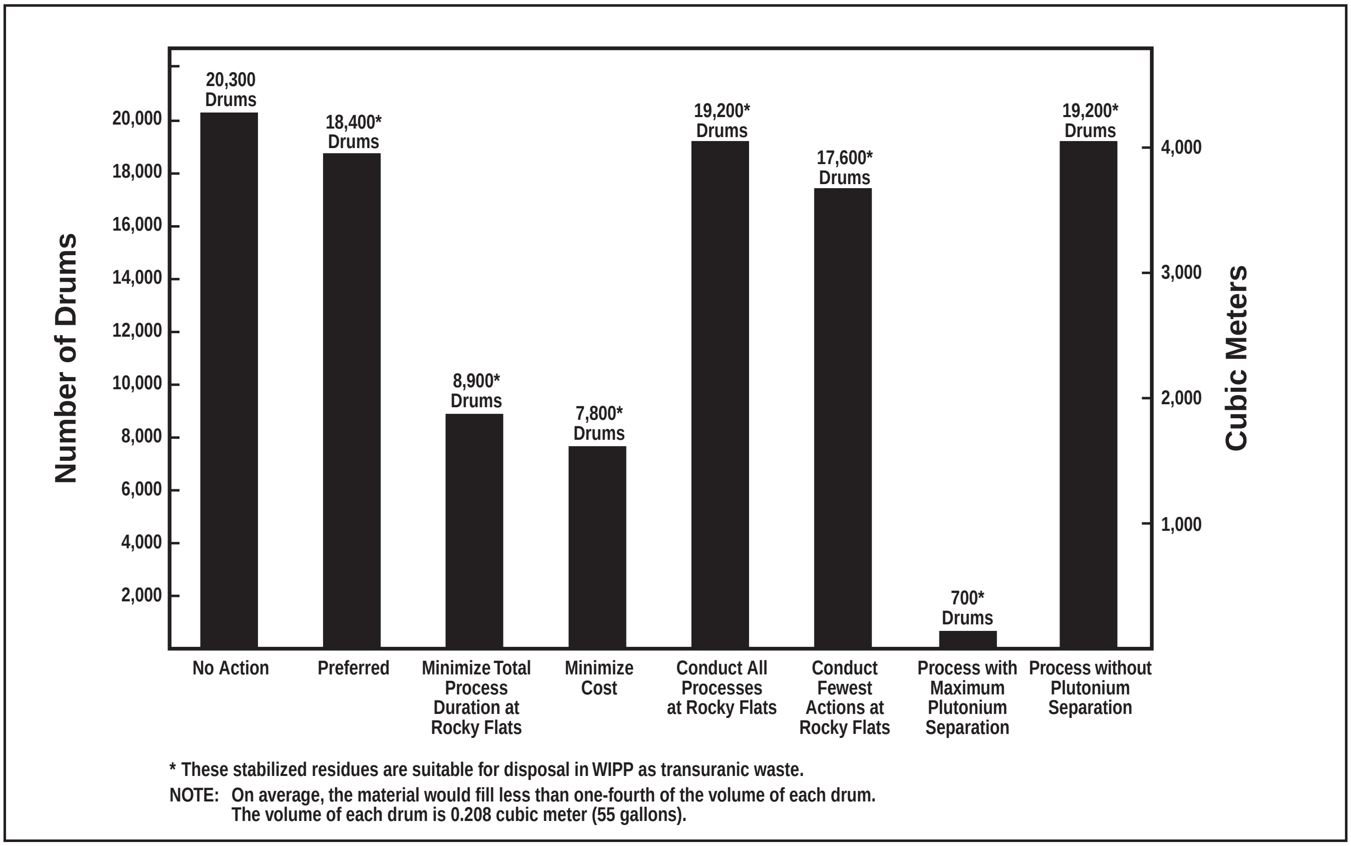

Figure S-18. Stabilized Residues Generated Under Each Management Approach

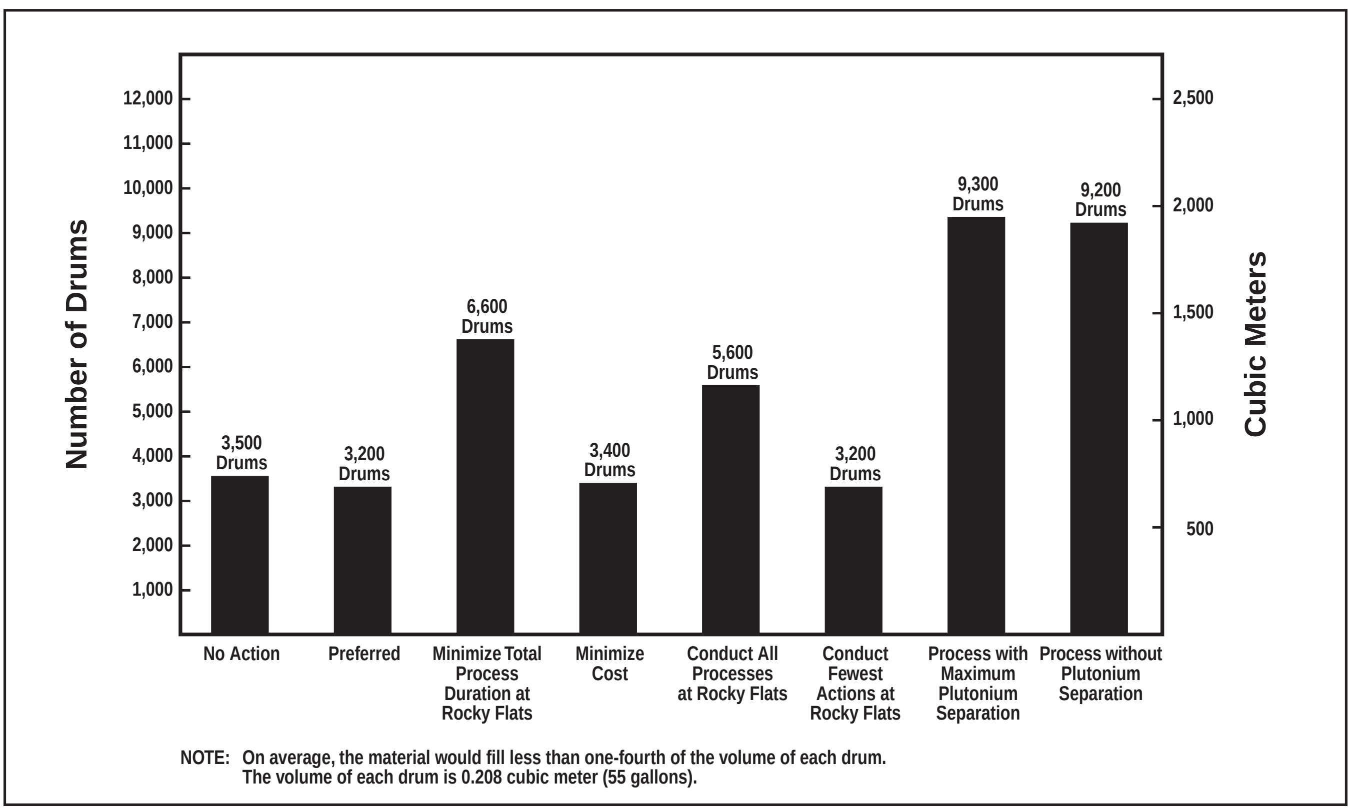

Figure S-19. Transuranic Waste Generated Under Each Management Approach

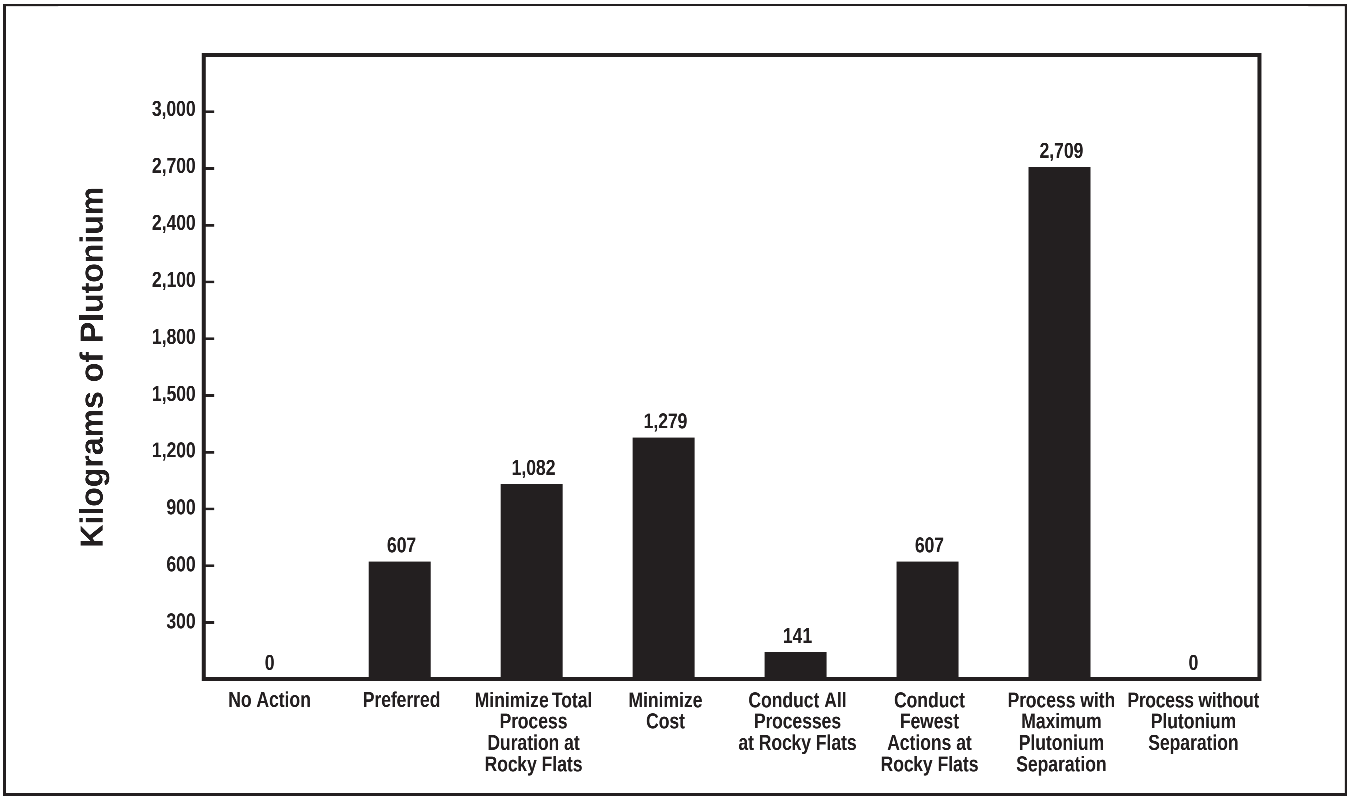

Figure S-20. Plutonium Separated Under Each Management Approach

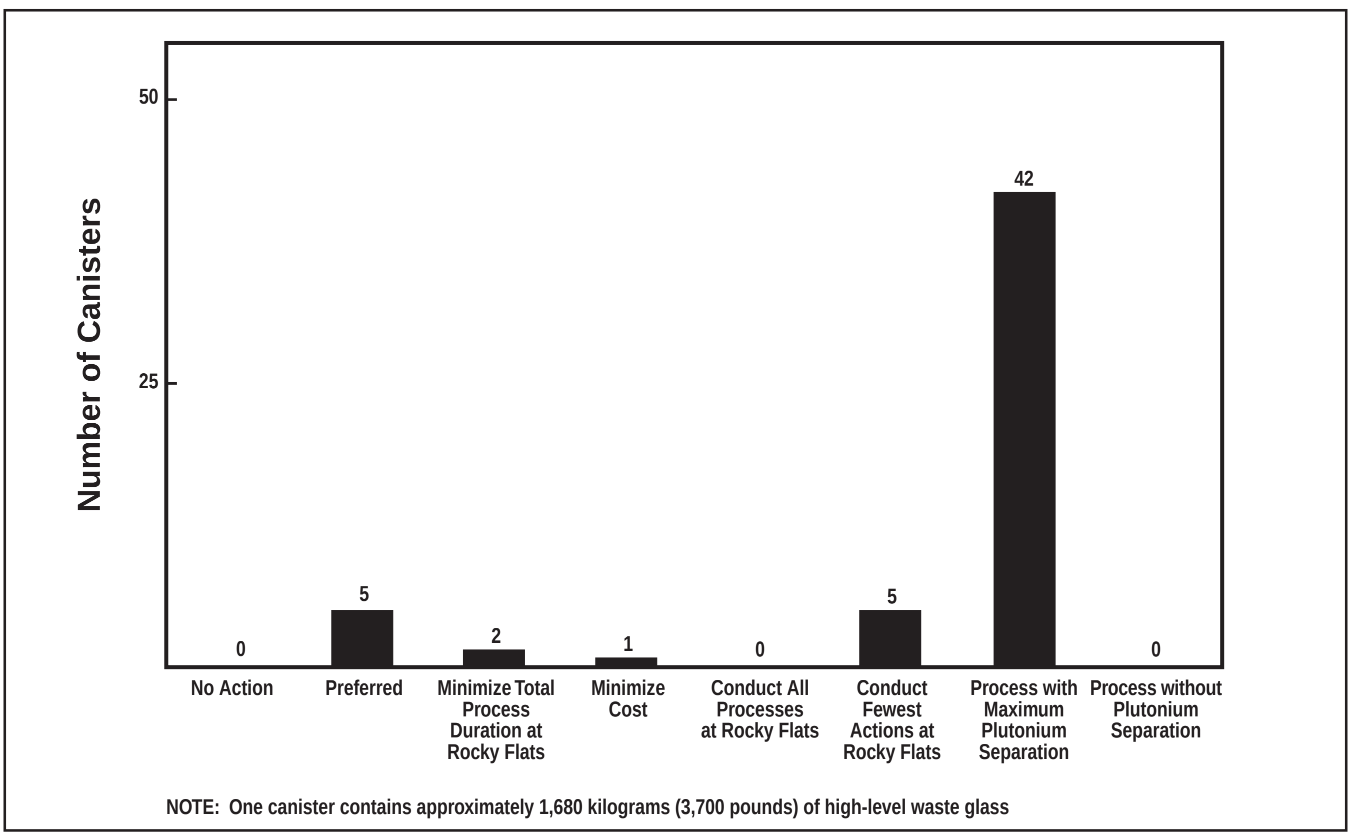

Figure S-21. Material Managed as High-Level Radioactive Waste That is Generated Under Each Management Approach

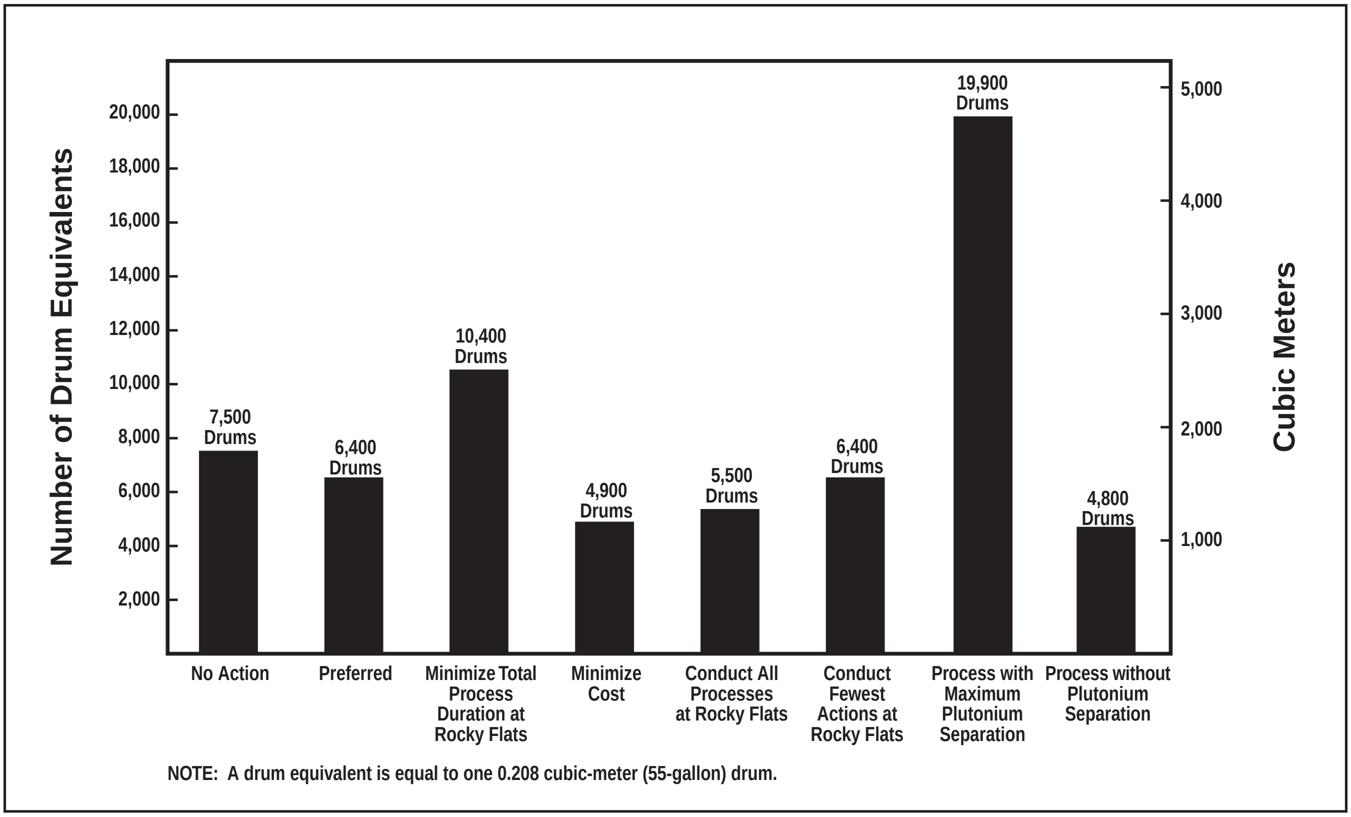

Figure S-22. Low-Level Radioactive Waste Generated Under Each Management Approach

4.2.2.1.2 PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY IMPACTS

All of the management approaches present low risks to the public and to workers. DOE estimates less than one additional latent cancer incidence in the general public as a result of exposure to radiation or hazardous chemicals, no matter which management approach is selected. Nevertheless, differences exist between the risks presented by the eight management approaches. Figures S-23 through S-27 display the risk comparisons for the public and workers under both incident-free and accident conditions.

The management approaches with intersite transportation would involve greater radiological risk to the public maximally exposed individual than the management approaches without intersite transportation because of the additional transportation involved. For the management approaches with intersite transportation (all approaches except No Action, Conduct All Processes at Rocky Flats, and Process Without Plutonium Separation), a conservative upper-bound estimate of the chance that this hypothetical individual would incur a latent cancer fatality would be about 5.5×10^{-6}, or less than one chance in 100,000. As shown in Figure S-23, the Maximum Plutonium Separation management approach presents a radiological risk of 0.0079 additional cancer fatalities among the public population, while the Preferred Alternative presents a risk of 0.0020 additional latent cancer fatalities. In all cases the estimated risks are low; no member of the public would be likely to incur a latent cancer fatality due to incident-free operations.

All the management approaches are equal in terms of the radiological risk to the maximally exposed individual worker (0.0008 cancer fatality per year). This is because DOE applied the same conservative assumption across the board for this part of the analysis — that the maximally exposed individual worker would be limited to DOE's Administrative Control Level of 2000 mrem per year. As shown in Figure S-24, all of the management approaches would cause less than 0.5 additional latent cancer fatalities among the worker population from exposure to radiation. DOE would not expect any additional latent cancer fatalities among workers under any of these approaches.

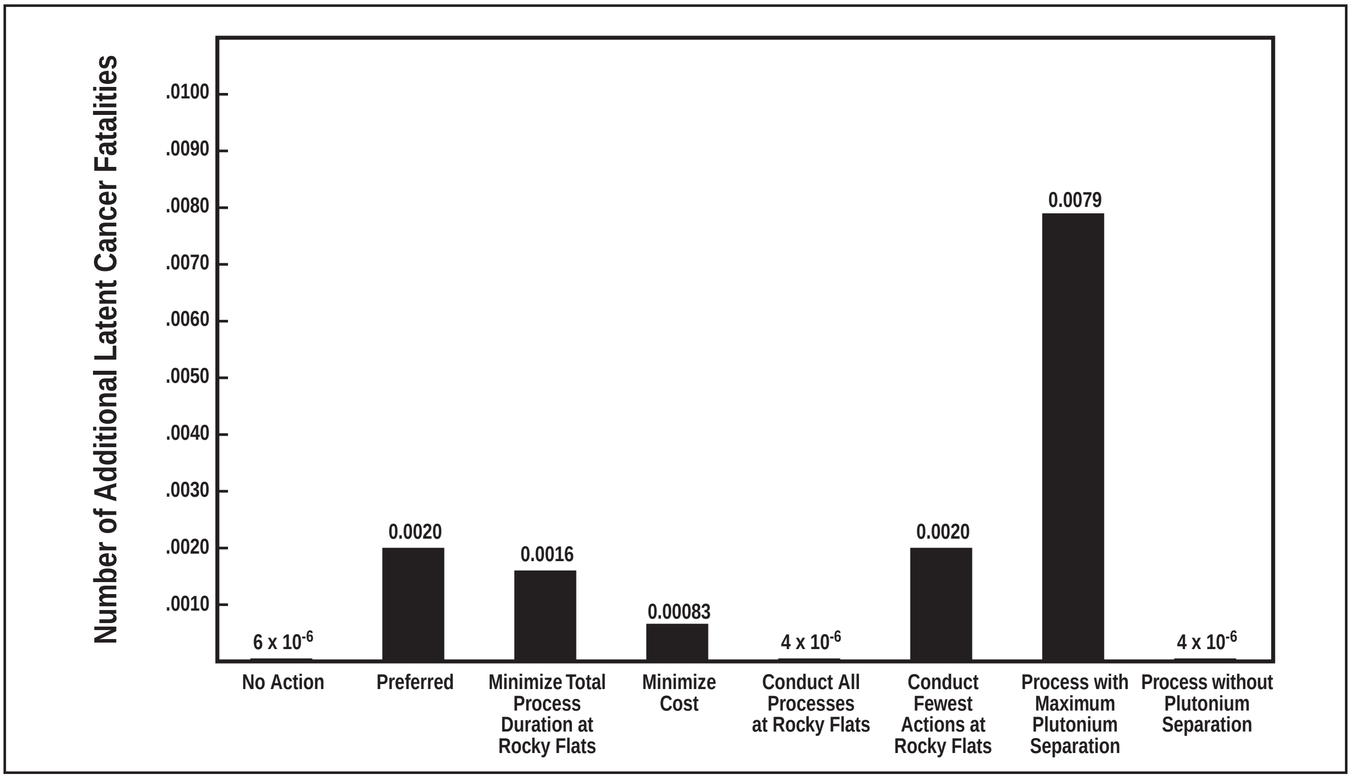

Figure S-23. Incident-Free Radiological Risk to the Public Population Under Each Management Approach

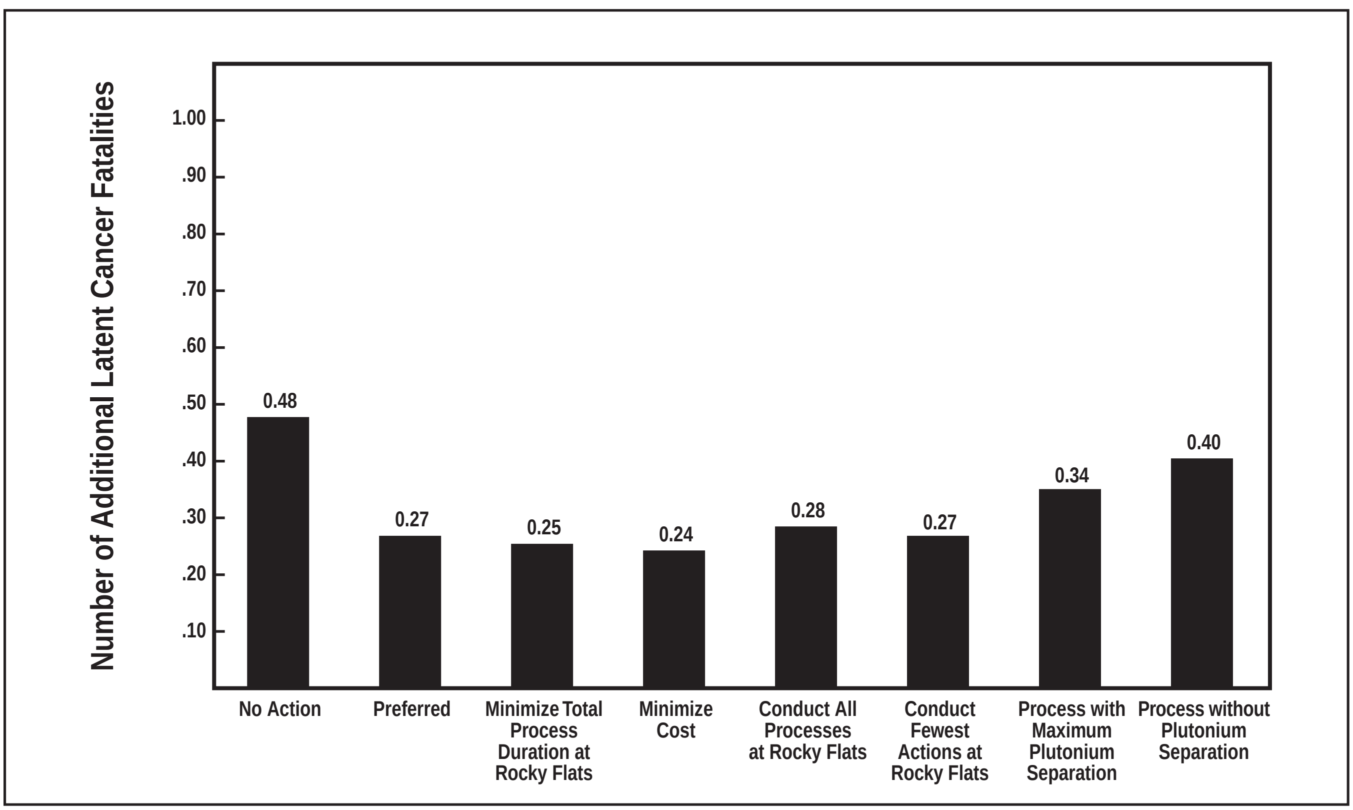

Figure S-24. Incident-Free Radiological Risk to the Involved Worker Population Under Each Management Approach

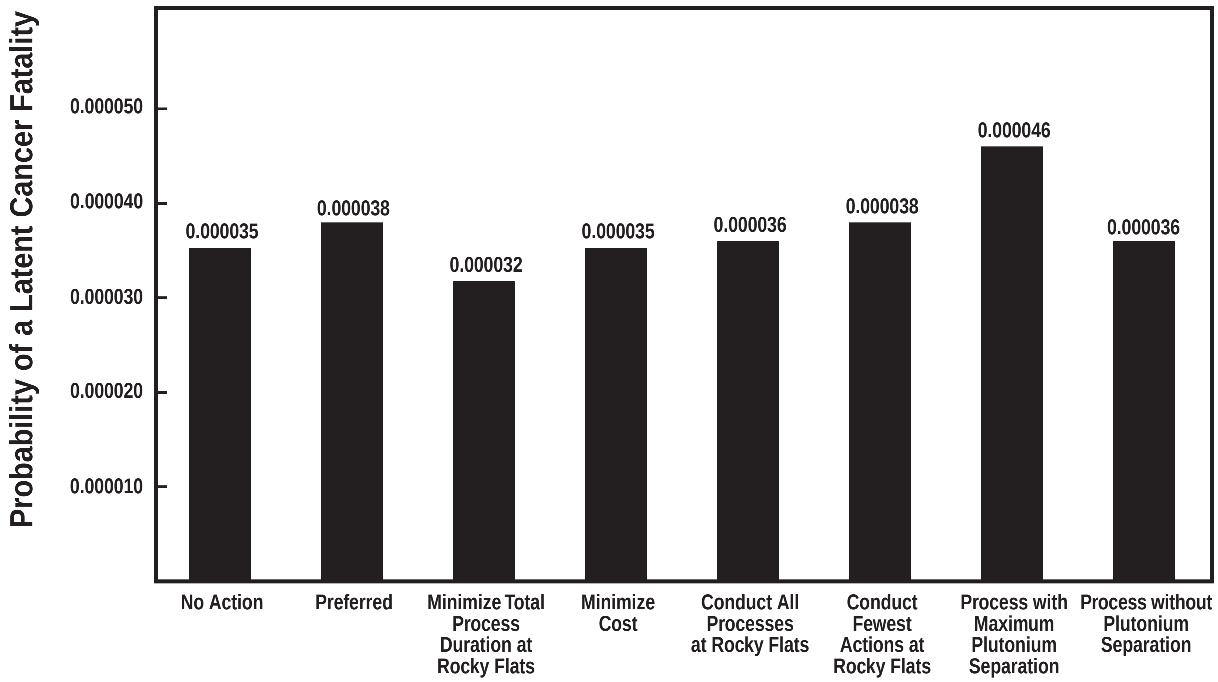

Figure S-25. Accident Risk to the Public Maximally Exposed Individual Under Each Management Approach

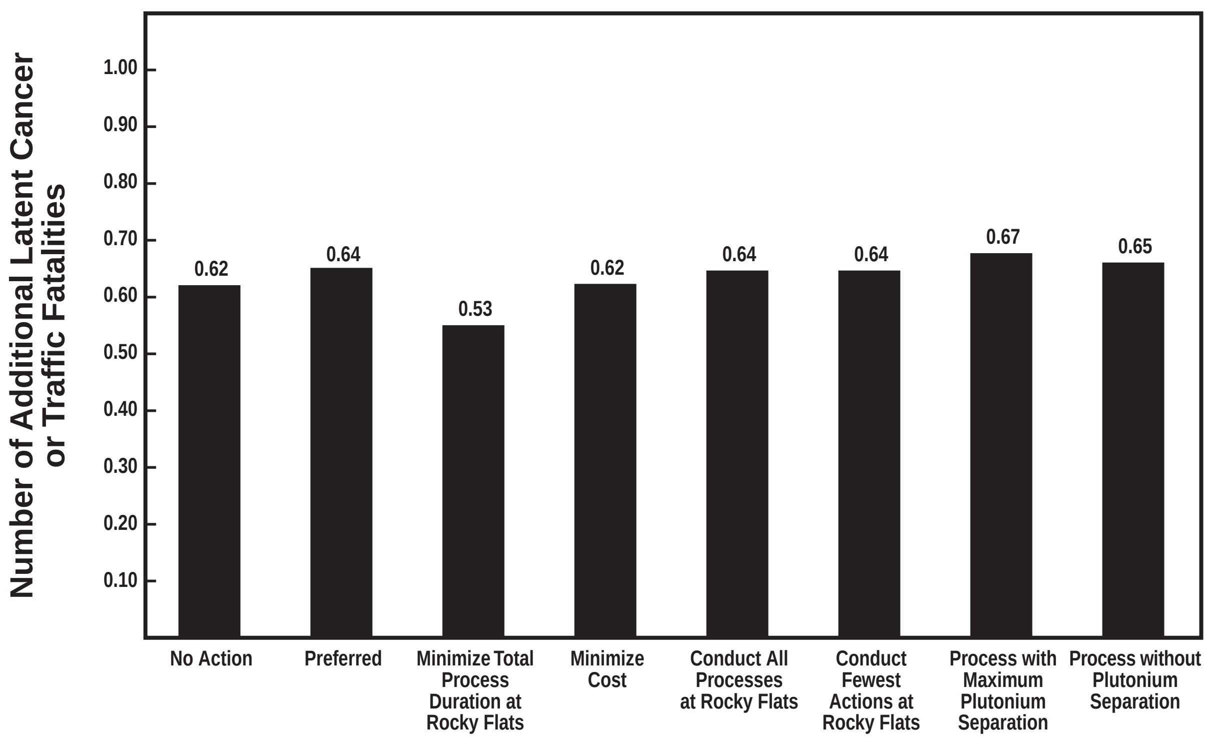

Figure S-26. Accident Risk to the Public Population Under Each Management Approach

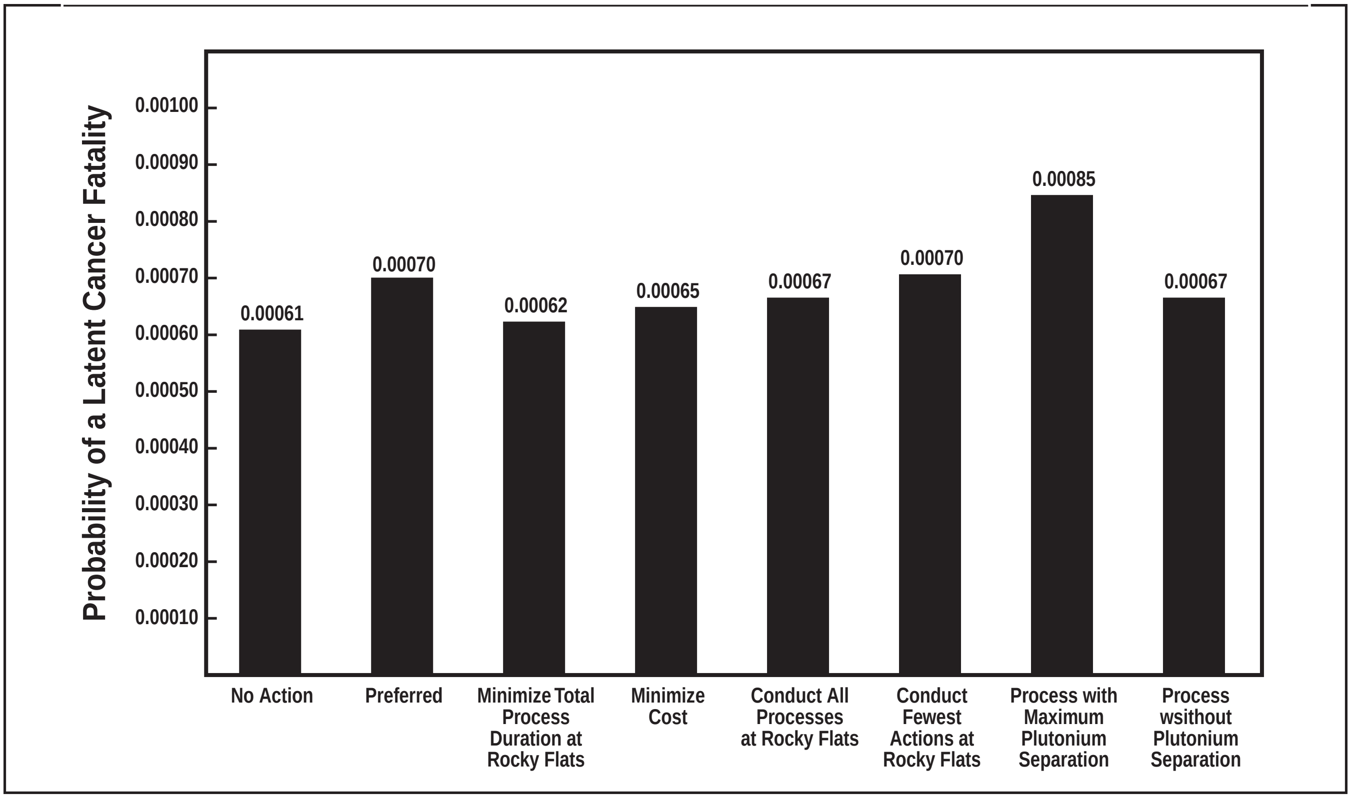

Figure S-27. Accident Risk to the Onsite Noninvolved Worker Under Each Management Approach

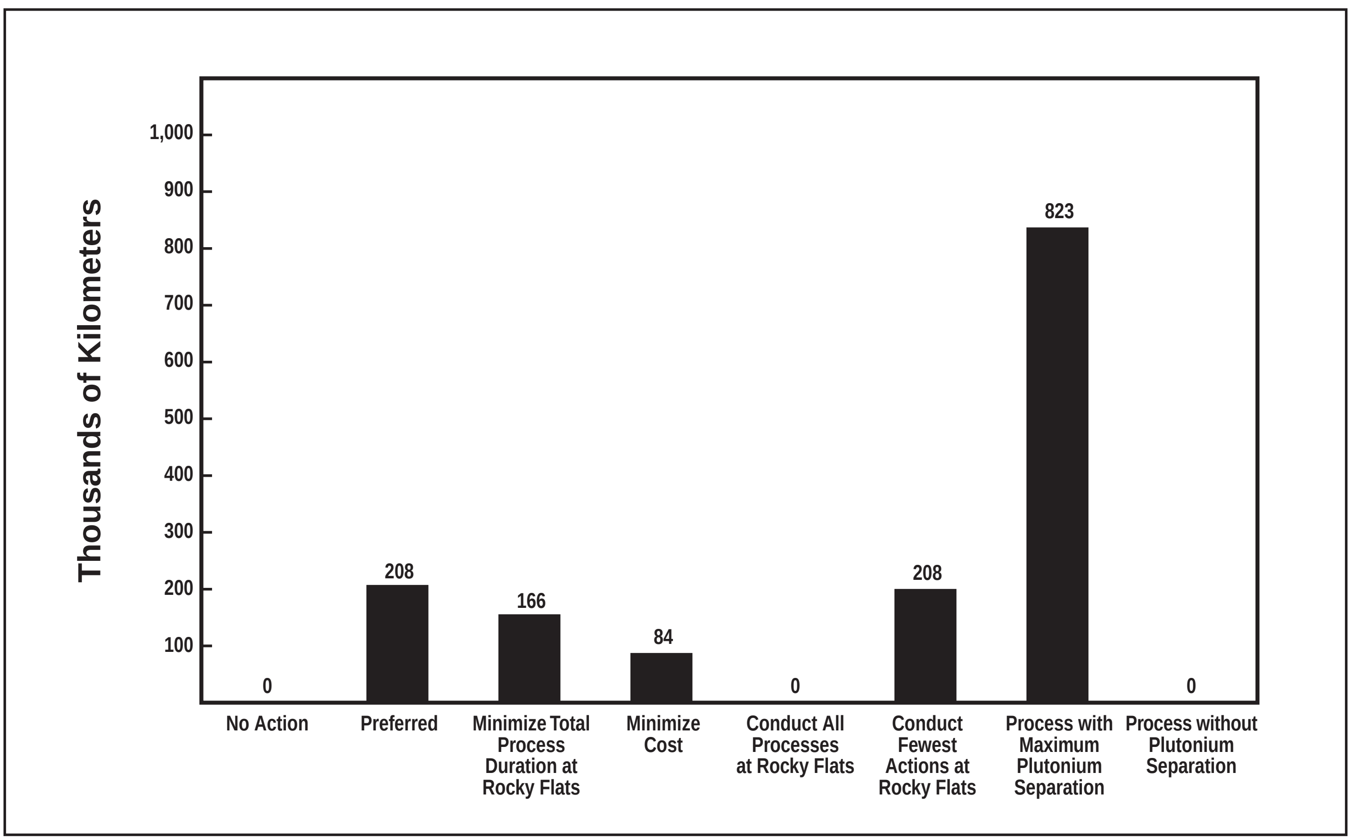

Figure S-28. Intersite Round-Trip Transportation Distance Required Under Each Management Approach

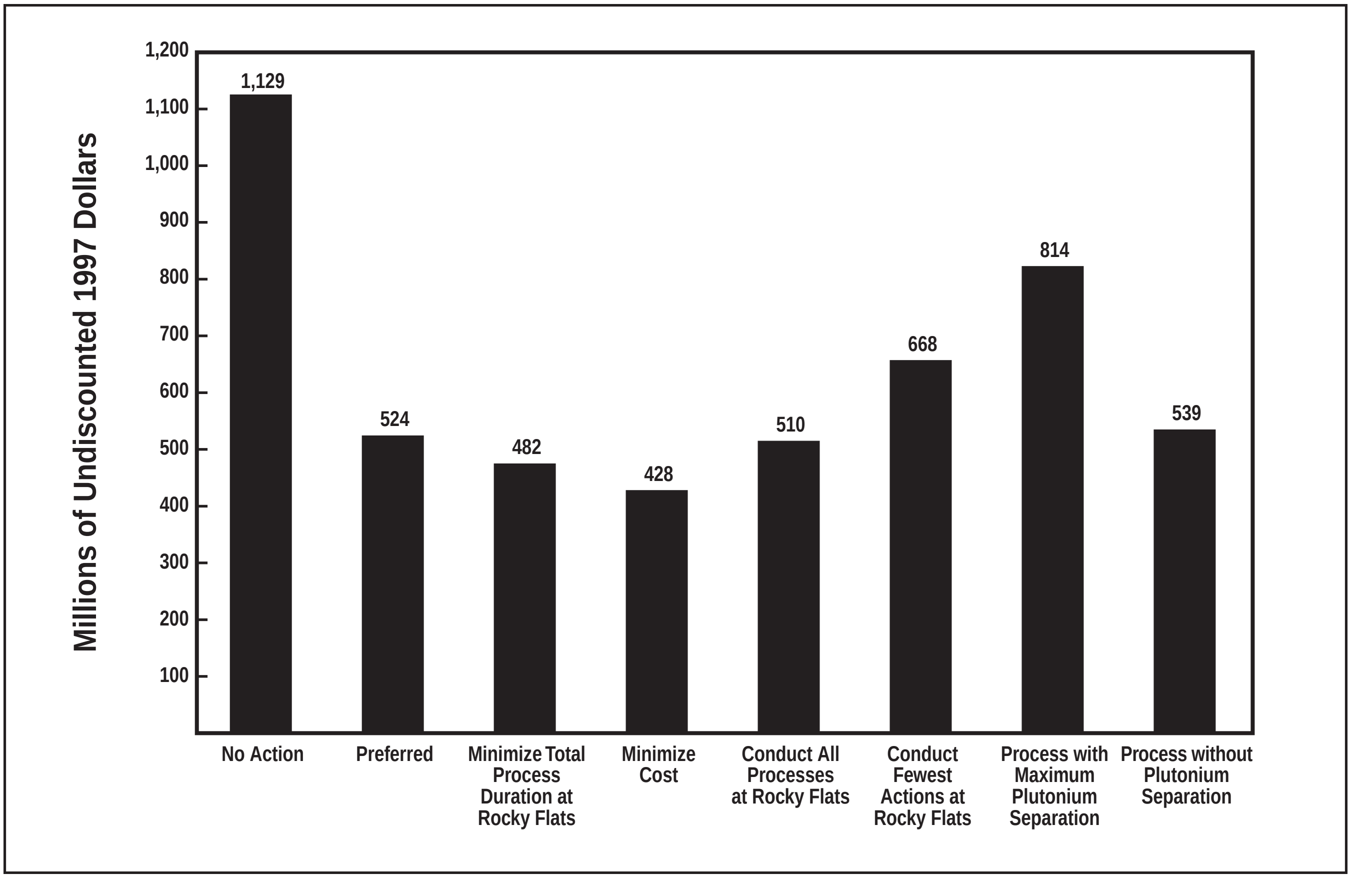

Figure S-29. Cost of Each Management Approach

All of the management approaches also present low risks to the public and to workers from exposure to hazardous chemicals. The probability of an excess latent cancer incidence for the member of the public and the worker expected to receive the highest exposure is less than 1 in one hundred million (0 to $3x10^{-9}$). Noncancer adverse health effects for the public and workers are also not expected since the Hazard Index values for all of the management approaches are much less than one, ranging from 0 to $1x10^{-7}$. The number of latent cancers resulting from exposure to facility emissions and transportation vehicle exhaust is estimated to be much less than one in the public and worker population for all management approaches.

As shown in Figures S-25, S-26, and S-27, the risks due to onsite and transportation accidents do not vary greatly among any of the management approaches. In general, the Minimize Total Process Duration at Rocky Flats approach, the Minimize Cost Management Approach, and the No Action Alternative present somewhat lower accident risks than the rest of the management approaches, but all the accident risks are very low.

4.2.2.1.3 OTHER IMPACTS

Five of the management approaches involve intersite transportation of plutonium residues and/or scrub alloy. Figure S-28 compares the total intersite transportation distances that would be required under each management approach. The Process with Maximum Plutonium Separation Management Approach would require about 823,000 km (511,000 mi) of intersite transportation, while the Preferred Alternative would require about 208,000 km (129,000 mi).

The cost comparison is presented in Figure S-29. Cost estimates range from $428 million for the Minimize Cost Management Approach to $1,129 million for the No Action Alternative. The Preferred Alternative has an estimated cost of $524 million.

4.2.3 RANGE OF RADIOLOGICAL AND CHEMICAL IMPACTS AT EACH SITE

All the residues could be processed at Rocky Flats, and portions of the residues could be processed at the Savannah River Site or Los Alamos National Laboratory. This section presents the range of radiological and chemical impacts which could result from the processing technologies at Rocky Flats, the Savannah River Site, and Los Alamos National Laboratory.

4.2.3.1 ROCKY FLATS

- ***Incident-Free Radiological Impacts*** — The range of radiological impacts to the public and the workers associated with incident-free implementation of various processing technologies at Rocky Flats is presented in Table S-9.

Table S-9. Range of Radiological Impacts Due to Incident-Free Operations at Rocky Flats

Offsite Public Maximally Exposed Individual		**Offsite Public Population**	
Dose (mrem)	*Probability of a Latent Cancer Fatality*	*Dose (person-rem)*	*Number of Latent Cancer Fatalities*
0.00012 to 0.00105	6.0×10^{-11} to 5.3×10^{-10}	0.0046 to 0.024	2.3×10^{-6} to 0.000012
Maximally Exposed Individual Worker		**Worker Population**	
Dose (mrem per year)	*Probability of a Latent Cancer Fatality Per Year*	*Dose (person-rem)*	*Number of Latent Cancer Fatalities*
2,000	0.00080	425 to 2,040	0.17 to 0.82

The public maximally exposed individual at Rocky Flats would be a hypothetical individual who lives downwind at the site boundary. The estimated total dose for this maximally exposed individual could range from 0.00012 mrem to 0.00105 mrem. This individual's chance of incurring a latent cancer fatality due to process operations would be less than one in one billion (6.0×10^{-11} to 5.3×10^{-10}).

The total public population radiation dose would range from 0.0046 person-rem to 0.024 person-rem. These doses would cause far less than one additional latent cancer fatality among the people living near the Rocky Flats site (2.3×10^{-6} to 0.000012). During incident-free storage, there would be no release of radioactive material, so the impact on the public would be equal to zero.

The maximally exposed individual worker dose assumes that an individual worker receives a dose below the DOE Administrative Control Level of 2,000 mrem per year to reflect DOE's commitment to maintain doses as low as reasonably achievable.

The total worker population radiation dose would be from 425 person-rem to 2,040 person-rem, which would cause 0.17 to 0.82 additional latent cancer fatalities among the workers directly involved in the operations. Onsite workers who are not involved with the actual processing of the residues are designated as noninvolved workers. The impacts to these workers would be much smaller than the impacts to the involved workers. During the post-processing storage period, inspections of the storage facility would expose the worker population to very small incremental additions.

- ***Incident-Free Hazardous Chemical Impacts*** — The range of impacts of hazardous chemical releases (e.g., carbon tetrachloride and hydrochloric acid) associated with incident-free implementation of the various processing technologies at Rocky Flats is presented in Table S-10. The probability of excess latent cancer incidence for the offsite population maximally exposed individual resulting from release ranges from 0 to $6x10^{-11}$. From zero to less than one latent cancer incidence is expected to occur in the offsite population of 2.4 million individuals living within an 80-kilometer radius of Rocky Flats. The Hazard Index Value is much less than 1, indicating that noncancer adverse health effects would not be expected in the offsite population.

Table S-10. Range of Chemical Impacts Due to Incident-Free Operations at Rocky Flats

Offsite Public Maximally Exposed Individual		**Offsite Public Population**
Probability of a Cancer Incidence	*Hazard Index*	*Number of Cancer Incidences*
0 to 6×10^{-11}	0 to 5×10^{-11}	0 to <1
Maximally Exposed Individual Worker		**Worker Population**
Probability of a Cancer Incidence	*Hazard Index*	*Number of Cancer Incidences*
0 to 3×10^{-9}	0 to 3×10^{-9}	0 to <1

The maximally exposed individual worker probability of excess latent cancer incidence ranges from 0 to $3x10^{-9}$. If all site workers were exposed to the maximally exposed individual concentration of carbon tetrachloride, which is an extremely conservative and unrealistic assumption, less than 1 excess latent cancer would be expected to occur in the workforce population. The Hazard Index value is much less than 1, which suggests that noncancer adverse health effects are not expected in the worker population.

- ***Radiological Impacts Due to Accidents*** — The range of radiological impacts to the public and the workers due to accidents during the implementation of the various processing technologies for plutonium residues and scrub alloy at Rocky Flats is presented in Table S-11.

Table S-11. Range of Radiological Impacts[a] Due to Accidents at Rocky Flats

Offsite Public Maximally Exposed Individual Risk	**Offsite Public Population Risk**	**Noninvolved Onsite Worker Maximally Exposed Individual Risk**
Probability of a Latent Cancer Fatality	*Number of Latent Cancer Fatalities*	*Probability of a Latent Cancer Fatality*
2.7×10^{-6} to 0.000042	0.031 to 0.66	0.000027 to 0.00067[b]

[a] *The impacts are given as risks, which are additive, rather than consequences, which are not additive for accidents.*

[b] *If an earthquake strong enough to collapse Building 707 and damage Building 371 occurs, 200 involved workers would be at risk of death or injury.*

The public maximally exposed individual at Rocky Flats would be a hypothetical individual who lives downwind at the site boundary. The public population is defined as the residential population within a radius of 80 km (50 mi). An onsite worker is defined as an individual worker who is located 100 m (328 ft) or more downwind from the release point when an accidental release of radioactive material occurs. (This is the same for all three sites evaluated.)

The estimated risk of a latent cancer fatality for the maximally exposed individual at Rocky Flats could range from 2.7×10^{-6} to 0.000042. This individual's chance of incurring a latent cancer fatality due to an accident during process operations would be increased by less than 1 in 10,000. The estimated risk of latent cancer fatalities for the general population would be in the range of 0.031 to 0.66. The fatal cancer risk to the onsite worker is in the range of 0.000027 to 0.00067. This onsite worker's chance of incurring a latent cancer fatality due to an accident during process operations would be increased by less than 1 in 1,000.

In any accident scenario, the individuals most likely to be injured are the involved workers. The risk to these workers would be due to both radiological and nonradiological effects. In a fire, the involved workers could be exposed to airborne radioactive material, in addition to the smoke and heat of the fire. In an explosion, there could be flying debris and containment barriers could be broken, exposing workers to airborne radioactive material. Most spills would not have a major effect on involved workers because they would clean up the spill wearing protective clothing and respirators as necessary. An accidental criticality could expose involved workers to large doses of prompt penetrating radiation, which could cause death in a short period of time. The earthquake and aircraft crash accident scenarios present very severe nonradiological effects to the involved workers. In these scenarios, the workers are likely to be hurt or killed from the collapse of the building or the impact of the aircraft crash before they could be evacuated.

The maximum number of involved workers at risk is estimated to be equal to the number of workers who would be working on plutonium residues or scrub alloy at any one time in each of the processing buildings at each of the three sites. Buildings 707 and 371 at Rocky Flats would each have about 100 involved workers inside, which is more involved workers than any facility at either of the other two sites. Thus, if an earthquake strong enough to collapse Building 707 and damage Building 371 hits Rocky Flats, approximately 200 involved workers would be at risk of death or injury due to activities associated with plutonium residues and scrub alloy. It is estimated that an earthquake strong enough to collapse Building 707 would occur once every 385 years. It is also estimated that an earthquake strong enough to collapse Building 371 would occur once every 10,700 years.

4.2.3.2 SAVANNAH RIVER SITE

- ***Incident-Free Radiological Impacts*** — The range of radiological impacts to the public and the workers associated with incident-free implementation of various processing technologies at the Savannah River Site is presented in Table S-12.

Table S-12. Range of Radiological Impacts Due to Incident-Free Operations at the Savannah River Site

Offsite Public Maximally Exposed Individual		**Offsite Public Population**	
Dose (mrem)	*Probability of a Latent Cancer Fatality*	*Dose (person-rem)*	*Number of Latent Cancer Fatalities*
0 to 0.0034	0 to 1.7×10^{-9}	0 to 0.38	0 to 0.00019
Maximally Exposed Individual Worker		**Worker Population**	
Dose (mrem per year)	*Probability of a Latent Cancer Fatality Per Year*	*Dose (person-rem)*	*Number of Latent Cancer Fatalities*
0 to 2,000	0 to 0.00080	0 to 469	0 to 0.19

Note: The lower value of each range is zero because it is possible that no processing would take place at the Savannah River Site.

The public maximally exposed individual at the Savannah River Site would be a hypothetical individual who lives downwind at the site boundary. The estimated total dose for this maximally exposed individual would range from 0 mrem to 0.0034 mrem. This individual's chance of incurring a latent cancer fatality due to process operations would be less than one in one-hundred million (0 to $1.7x10^{-9}$).

The total public population radiation dose would range from 0 person-rem to 0.38 person-rem. The dose is estimated to result in less than one additional latent cancer fatality among the people living near the Savannah River Site (0 to 0.00019). During incident-free storage, there would be no release of radioactive material, so the impact on the public would be equal to zero.

The maximally exposed individual worker dose range assumes that an individual worker receives a dose below the DOE Administrative Control Level of 2,000 mrem per year to reflect DOE's commitment to maintain doses as low as reasonably achievable.

The total worker population radiation dose would range from 0 person-rem to 469 person-rem, which would cause 0 to 0.19 additional latent cancer fatalities among the workers directly involved in the operations. Onsite workers who are not involved with the actual processing of the residues are designated as noninvolved workers. The impacts to these workers would be much smaller than the impacts to the involved workers. During the post-processing storage period, inspections of the storage facility would expose the worker population to small incremental additions.

- ***Incident-Free Hazardous Chemical Impacts*** — The range of impacts of hazardous chemical releases associated with incident-free implementation of the various processing technologies at the Savannah River Site is presented in Table S-13. No carcinogenic chemicals are expected to be released from the processing of plutonium residues and scrub alloy at the Savannah River Site; therefore, maximally exposed individual cancer probability and population cancer incidences were not evaluated for the offsite population or workers. The Hazard Index value is much less than 1, which suggests that noncancer adverse health effects are not expected for the offsite maximally exposed individual as a result of releases of phosphoric acid and ammonium nitrate. The Hazard Index value for the maximally exposed worker is also much less than 1. Therefore, noncancer adverse health effects are not expected among the worker population.

Table S-13. Range of Chemical Impacts Due to Incident-Free Operations at the Savannah River Site

Offsite Public Maximally Exposed Individual		**Offsite Public Population**
Probability of a Cancer Incidence	*Hazard Index*	*Number of Cancer Incidences*
N/A	0 to 2×10^{-9}	N/A
Maximally Exposed Individual Worker		**Worker Population**
Probability of a Cancer Incidence	*Hazard Index*	*Number of Cancer Incidences*
N/A	0 to 2×10^{-8}	N/A

N/A = not applicable

- ***Radiological Impacts Due to Accidents*** — The range of radiological impacts to the public and the workers due to accidents during the implementation of the various processing technologies for the processing of plutonium residues and scrub alloy at the Savannah River Site is presented in Table S-14.

  The estimated risk of a latent cancer fatality for the maximally exposed individual could range from 0 to $2.5x10^{-7}$. This individual's chance of incurring a latent cancer fatality due to an accident during processing operations would be increased by less than one in one million. The estimated risk of latent cancer fatalities for the general population could be in the range of 0 to 0.011. The onsite worker risk is in the range of 0 to

0.000078. This onsite worker's chance of incurring a latent cancer fatality due to an accident during processing operations would be increased by less than 1 in 10,000.

Table S-14. Range of Radiological Impacts[a] Due to Accidents at the Savannah River Site

Offsite Public Maximally Exposed Individual Risk	Offsite Public Population Risk	Noninvolved Onsite Worker Maximally Exposed Individual Risk
Probability of a Latent Cancer Fatality	*Number of Latent Cancer Fatalities*	*Probability of a Latent Cancer Fatality*
0 to 2.5×10^{-7}	0 to 0.011	0 to 0.000078[b]

[a] *The impacts are given as risks, which are additive, rather than consequences, which are not additive for accidents.*

[b] *If an earthquake strong enough to damage H-Canyon and H-B Line occurs, 54 involved workers could be at risk of death or injury.*

Note: The lower value of each range is zero since it is possible that no processing will take place at the Savannah River Site.

4.2.3.3 LOS ALAMOS NATIONAL LABORATORY

- ***Incident-Free Radiological Impacts*** — The range of radiological impacts to the public and the workers associated with incident-free implementation of various processing technologies at Los Alamos National Laboratory is presented in Table S-15.

Table S-15. Range of Radiological Impacts Due to Incident-Free Operations at Los Alamos National Laboratory

Offsite Public Maximally Exposed Individual		Offsite Public Population	
Dose (mrem)	*Probability of a Latent Cancer Fatality*	*Dose (person-rem)*	*Number of Latent Cancer Fatalities*
0 to 0.00080	0 to 4.0×10^{-10}	0 to 0.0024	0 to 1.2×10^{-6}
Maximally Exposed Individual Worker		**Worker Population**	
Dose (mrem per year)	*Probability of a Latent Cancer Fatality Per Year*	*Dose (person-rem)*	*Number of Latent Cancer Fatalities*
0 to 2,000	0 to 0.00080	0 to 160	0 to 0.064

Note: The lower value of each range is zero because it is possible that no processing would take place at Los Alamos National Laboratory.

The public maximally exposed individual at Los Alamos National Laboratory would be a hypothetical individual who lives downwind of anticipated releases. As shown in Table S-15, the estimated total dose for this maximally exposed individual would range from 0 mrem to 0.00080 mrem. This individual's chance of incurring a latent cancer fatality due to processing operations would be less than one in one billion (0 to 4.0×10^{-10}).

The total public population radiation dose would range from 0 person-rem to 0.0024 person-rem. The dose is small and would cause far less than one additional latent fatal cancer among the people living near Los Alamos National Laboratory (0 to 1.2×10^{-6}). During incident-free storage, there would be no release of radioactive material, so the impact on the public would be equal to zero.

The maximally exposed individual worker dose range assumes that an individual worker receives a dose below the DOE Administrative Control Level of 2,000 mrem per year to reflect DOE's commitment to maintain doses as low as reasonably achievable.

The total worker population radiation dose would range from 0 person-rem to approximately 160 person-rem, which would cause 0 to 0.064 additional latent cancer fatalities among the workers directly involved in the operations. Onsite workers who are not involved with the actual processing of the residues are designated as noninvolved workers. The impacts to these workers would be much smaller than the impacts to the involved workers. During the post-processing storage period, inspections of the storage facility would expose the worker populations to very small incremental additions.

- ***Incident-Free Hazardous Chemical Impacts*** — No hazardous chemicals are expected to be released from the proposed processing of plutonium residues at Los Alamos National Laboratory under the various processing technologies evaluated in this EIS.

- ***Radiological Impacts Due to Accidents*** — The range of radiological impacts to the public and the workers due to accidents during the implementation of the various processing technologies for plutonium residues at Los Alamos National Laboratory is presented in Table S-16.

Table S-16. Range of Radiological Impacts[a] Due to Accidents at Los Alamos National Laboratory

Offsite Public Maximally Exposed Individual Risk	Offsite Public Population Risk	Noninvolved Onsite Worker Maximally Exposed Individual Risk
Probability of a Latent Cancer Fatality	*Number of Latent Cancer Fatalities*	*Probability of a Latent Cancer Fatality*
0 to 0.000028	0 to 0.037	0 to 0.00048[b]

[a] *The impacts are given as risks, which are additive, rather than consequences, which are not additive for accidents.*

[b] *If an earthquake occurs at TA-55 strong enough to damage Building PF-4, 30 involved workers would be at risk of death or injury.*

Note: The lower value of each range is zero since it is possible that no processing will take place at Los Alamos National Laboratory.

The estimated risk of a latent cancer fatality for the maximally exposed individual at Los Alamos National Laboratory would range from 0 to 0.000028. This individual's chance of incurring a latent cancer fatality due to an accident during processing operations would be increased by less than 1 in 10,000. The estimated risk of latent cancer fatalities for the general population would be in the range of 0 to 0.037. The fatal cancer risk to the onsite worker is in the range of 0 to 0.00048. This onsite worker's chance of incurring a latent cancer fatality due to an accident during processing operations would be increased by less than 1 in 1,000.

4.2.4 RANGE OF WASTES GENERATED AT EACH SITE

The minimum and maximum amounts of wastes generated from processing the plutonium residues and scrub alloy addressed in this EIS are included in Table S-19 (for Rocky Flats), S-21 (for the Savannah River Site), and S-23 (for Los Alamos National Laboratory). The types of wastes included in these tables are stabilized residues (only at Rocky Flats), transuranic waste, low-level waste, low-level mixed waste, material managed as high-level waste (only at the Savannah River Site) and saltstone (only at the Savannah River Site).

As an example, from Table S-19, the range of low-level waste from processing at Rocky Flats would range from 900 m^3 (31,800 ft^3) to 12,100 m^3 (427,000 ft^3).

4.2.5 RANGE OF INTERSITE TRANSPORTATION IMPACTS

Some of the processing options would require transporting plutonium residues or scrub alloy from Rocky Flats to either the Savannah River Site or Los Alamos National Laboratory. Considering all the options, the number of truck shipments from Rocky Flats to the Savannah River Site could range from 0 to 208, and the number of truck shipments from Rocky Flats to Los Alamos National Laboratory could range from 0 to 63. (Refer to section 2.8 of this Summary.) This section describes the estimated radiation dose rate near the transport containers and the range of radiological and chemical impacts which could result from intersite transportation. The detailed analysis of the intersite transportation impacts are presented in Appendix E of the EIS.

The regulatory external radiation dose limit for ground transport is 10 mrem per hour at 2 m (6.6 ft) from the vehicle (49 CFR 173.441). Historical data from actual plutonium residue and scrub alloy handling experience have shown dose rates below this regulatory limit. Dose rates at 2 m (6.6 ft) from the Type 9975 and Type 6M containers have often been between 0.15 and 0.6 mrem per hour, depending on the age and type of residue. Because Safe Secure Trailers carry up to 30 Type 9975 and 38 Type 6M containers, dose rates around the vehicle could be higher than around a single container, but would be lower than the regulatory limit.

To be conservative, the analyses in this EIS assume that dose rates around the vehicle would equal the regulatory limit of 10 mrem per hour at 2 m (6.6 ft) from the side of the transport vehicle. This conservative value was used in the calculation of incident-free doses to members of the public and ground transport workers. For radiation workers handling containers at the DOE sites, the dose rate to the maximally exposed worker was conservatively assumed to be 2,000 mrem per year, which is equal to the DOE Administrative Control Level.

The range of radiological impacts due to incident-free transportation is presented in Table S-17. For every impact, the low end of the range is always zero because there are options that involve no transportation. The high end of each range is always low, which indicates that DOE would expect no latent cancer fatalities among the public or workers (0 to 0.025) from any combination of transportation options.

The only chemical impact would be latent cancer fatalities due to vehicle exhaust. The vehicle exhaust gases from the maximum number of truck shipments (round trip) from Rocky Flats to the Savannah River Site and to Los Alamos National Laboratory could cause 0.003 and 0.0003 latent cancer fatalities, respectively.

The potential impacts due to transportation accidents are presented in Table S-18. For every impact, the low end of the range is always zero because there are options that involve no transportation. The table shows that the risk of prompt death due to the trauma of a traffic accident is much greater than the risk due to radiological exposure following an accident. The highest risk is 0.021, which means that there would be about a 2 percent chance of one traffic fatality if DOE decides to make all 208 possible truck shipments to the Savannah River Site.

Table S-17. Range of Radiological Impacts Due to Incident-Free Transportation

	Offsite Public Maximally Exposed Individual		Offsite Public Population	
Origin/Destination	*Dose (mrem)*	*Probability of a Latent Cancer Fatality*	*Dose (person-rem)*	*Number of Latent Cancer Fatalities*
Rocky Flats/Savannah River Site	0 to 11	0 to 5.5 x 10^{-6}	0 to 21	0 to 0.010
Rocky Flats/Los Alamos National Laboratory	0 to 11	0 to 5.5 x 10^{-6}	0 to 1.7	0 to 0.00085
	Maximally Exposed Individual Transport Worker		**Transport Worker Population**	
Origin/Destination	*Dose (mrem per yr)*	*Probability of a Latent Cancer Fatality Per Year*	*Dose (person-rem)*	*Number of Latent Cancer Fatalities*
Rocky Flats/Savannah River Site	0 to 100	0 to 0.000040	0 to 32	0 to 0.013
Rocky Flats/Los Alamos National Laboratory	0 to 100	0 to 0.000040	0 to 2.6	0 to 0.0010

Table S-18. Range of Impacts[a] Due to Transportation Accidents

	Offsite Public Population Radiological Risk	Offsite Public Population and Worker Trauma Risk
Origin/Destination	*Number of Latent Cancer Fatalities*	*Probability of One Traffic Fatality*[b]
Rocky Flats/Savannah River Site	0 to 6.0×10^{-6}	0 to 0.021
Rocky Flats/Los Alamos National Laboratory	0 to 3.6×10^{-7}	0 to 0.0018

[a] *The impacts are given as risks, which are additive, rather than consequences, which are not additive for accidents.*

[b] *These probabilities are associated with traveling round-trip.*

4.2.6 ENVIRONMENTAL JUSTICE

Executive Order 12898 directs Federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of agency actions on minority populations and low-income populations. Analyses of the alternatives evaluated in this EIS to manage the plutonium residues and scrub alloy predict only minimal risks to health and safety. Because none of the alternatives would be expected to cause high and adverse consequences to the public at large, no minority or low-income populations would be expected to experience disproportionately high and adverse consequences. A more detailed discussion of the analysis of Environmental Justice is included in Appendix F of the Final EIS.

4.2.7 CUMULATIVE IMPACTS

The cumulative impacts from the management of plutonium residues and scrub alloy for each site are identified in Tables S-19, S-21, and S-23. The cumulative impacts include impacts from current and future activities at each site, along with the impacts from this EIS. The minimum and maximum impacts are based on the range of possible impacts at each site. The ranges of impacts are presented in Section 4.23 of the Final EIS. The cumulative impacts do not directly correlate to the management approaches presented in Section 4.2.2 of the Summary and Section 4.22 of the EIS.

Processing of residues and scrub alloy would contribute small additions to the amounts of products and wastes generated from other existing or planned activities at each of the three sites. In addition, the radiological and chemical releases associated with normal operations of any of the processing alternatives evaluated in this EIS would result in less than one cancer fatality to the offsite populations around each site. The contribution to existing and projected impacts associated with all other site activities would be small.

4.2.7.1 Rocky Flats

Tables S-19 and S-20 identify the cumulative waste, radiological and air quality impacts resulting from the management of the plutonium residues and scrub alloy addressed in this EIS, other future actions, and current activities.

Table S-19. Rocky Flats Cumulative Radiological Impacts

Impact Category	*Impacts of Existing Operations*[b]	**Plutonium Residue and Scrub Alloy Impacts**			*Impacts of Other Reasonably Foreseeable Future Actions*[b]	**Cumulative Impacts**[a]		
		Min.	*Max.*	*Preferred*		*Min.*[c]	*Max.*[d]	*Preferred*[e]
Waste Generation								
Stabilized Residues (drums)[f]	0	0	21,300	17,600	0	0	21,300	17,600
Transuranic Waste (cubic meters)	6,300	400	8,200	500	4,900	11,600	19,400	11,700
Low-Level Waste (cubic meters)	41,000	900	12,100	900	96,000	138,000	149,000	138,000
Low-Level Mixed Waste (cubic meters)	21,000	0	0	0	192,000	213,000	213,000	213,000
Offsite Population								
Collective Dose, 10 years (person-rem)	1.6	0.0046	0.024	0.0057	228	230	230	230
Number of latent cancer fatalities from collective dose	0.00080	2.3×10^{-6}	0.000012	2.9×10^{-6}	0.11	0.11	0.11	0.11
Offsite Maximally Exposed Individual								
Annual Dose, Atmospheric Releases (mrem)	0.00047	0.00012	0.00105	0.00019	0.23	0.23	0.23	0.23
Probability of a Latent Cancer Fatality	2.3×10^{-10}	6.0×10^{-11}	5.3×10^{-10}	9.5×10^{-11}	1.2×10^{-7}	1.2×10^{-7}	1.2×10^{-7}	1.2×10^{-7}
Worker Population								
Collective Dose, 10 years (person-rem)	2,630	425	2,040	582	1,723	4,778	6,393	4,935
Number of latent cancer fatalities from collective dose	1.1	0.17	0.82	0.23	0.69	2.0	2.6	2.0

[a] *Impacts of existing operations, combined impacts from processing Rocky Flats plutonium residues and scrub alloy, and impacts of other reasonably foreseeable future actions.*

[b] *These are described in the Final Waste Management Programmatic Environmental Impact Statement and in Section 4.25 of the Final EIS.*

[c] *Cumulative impacts, including minimum combined impacts from processing Rocky Flats plutonium residues and scrub alloy.*

[d] *Cumulative impacts, including maximum combined impacts from processing Rocky Flats plutonium residues and scrub alloy.*

[e] *Cumulative impacts, including combined impacts from processing Rocky Flats plutonium residues and scrub alloy under the Preferred Alternative.*

[f] *Standard 55-gallon (208-liter) drums.*

Table S-20. Cumulative Air Quality Impacts at Rocky Flats

Pollutant	*Baseline Concentration ($\mu g/m^3$)*	*Modeled Concentration ($\mu g/m^3$)*	*Concentration from Other Onsite Sources[a] ($\mu g/m^3$)*	*Total Concentration ($\mu g/m^3$)*	*Averaging Time*	*Most Stringent Regulation or Guideline ($\mu g/m^3$)[b]*
Nitrogen Dioxide	1.4	0.00014	0.0	1.4	Annual	100
Hydrochloric Acid	0.0052	4.2×10^{-7}	0.001	0.0062	Annual	N/A
Carbon Tetrachloride	0.0024	0.000031	0.002	0.0044	Annual	N/A

N/A = Not Applicable

[a] *Other approved onsite sources that would be operating at the same time as the plutonium residues and scrub alloy processing at Rocky Flats.*

[b] *Federal and State standards.*

- ***Wastes*** — Existing operations and other reasonably foreseeable future actions would not generate any stabilized residues that have plutonium concentrations above the safeguards termination limits. The minimum amount of stabilized residues that could be generated under this EIS is also zero because for every material category there is at least one processing technology that would not generate any. Alternatives 1 and 4 would generate stabilized residues, while Alternatives 2 and 3 would not. Existing and future operations at Rocky Flats (other than processing residues and scrub alloy) will generate approximately 6,300 m^3 (222,000 ft^3) and 4,900 m^3 (173,000 ft^3), respectively, of transuranic waste with plutonium concentrations below the safeguards termination limits. This will result in a total of 11,200 m^3 (395,500 ft^3) of transuranic waste. The maximum estimated volume of transuranic waste from plutonium residues and scrub alloy is 8,200 m^3 (290,000 ft^3), which would represent a major increase over the 11,200 m^3 (395,500 ft^3) from existing and future operations. The minimum amount of transuranic waste that could be generated at Rocky Flats would be about 400 m^3 (14,100 ft^3), which would occur if most of the plutonium residues and scrub alloy are simply repackaged at Rocky Flats. Existing and future operations at Rocky Flats will generate approximately 41,000 m^3 (1,448,000 ft^3) and 96,000 m^3 (3,390,000 ft^3), respectively, of low-level waste. This will result in a total of 137,000 m^3 (4,840,000 ft^3) of low-level waste. The maximum estimated volume from plutonium residues and scrub alloy is 12,100 m^3 (427,000 ft^3), which would represent an increase of less than 10 percent of the 137,000 m^3 (4,840,000 ft^3) from existing and future operations. Table S-19 also shows that the largest volume of waste at Rocky Flats is low-level mixed waste. DOE has estimated that existing and future operations will generate approximately 213,000 m^3 (7,520,000 ft^3) of low-level mixed waste, while the processing of plutonium residues and scrub alloy is not expected to generate any low-level mixed waste.

- ***Radiological Impacts*** — As identified in Table S-19, the radioactive releases that would result from processing the Rocky Flats plutonium residues and scrub alloy would not noticeably increase the radiation dose or the associated number of latent cancer fatalities in the offsite population. In addition, the radiation dose to the maximally exposed individual would remain well below the DOE regulatory limit of 10 mrem per year from atmospheric releases (DOE Order 5400.5). The radiation dose to the involved worker population could increase by about 47 percent over the dose from existing operations and other reasonably foreseeable future actions over the 10-year processing period. However, doses to individual involved workers will be kept below the regulatory limit of 5,000 mrem per year (10 CFR Part 835). Furthermore, as low as reasonably achievable principles will be exercised to maintain individual worker doses below the DOE Administrative Control Level of 2,000 mrem per year. Each DOE site also maintains its own Administrative Control Level, but for the sake of consistency, DOE used the 2,000 mrem per year throughout this EIS. Transportation workers (e.g., drivers) will be held to an annual limit of 100 mrem per year because they are not certified radiation workers. All worker doses are routinely monitored, and if any individual worker's dose approaches the annual limit, he or she would be rotated into another job.

- ***Air Quality Impacts*** — The processing of plutonium residues and scrub alloy at Rocky Flats would involve potential releases of nitrogen dioxide, hydrochloric acid, and carbon tetrachloride. The modeled offsite concentrations of these pollutants are presented in Table S-20, along with the existing concentrations and concentrations from other onsite sources that would be operating at the same time as the plutonium residues and scrub alloy processing.

  Because the total concentrations are small compared to the standards or guidelines, the cumulative impacts of the Proposed Action and the existing baseline should not be of concern with respect to these pollutants at Rocky Flats.

  Rocky Flats is in a nonattainment area where standards for criteria air pollutants are exceeded for particulates, carbon monoxide, and ozone. Section 176c of the 1990 Clean Air Act, as amended, requires that all Federal actions conform with the applicable State Implementation Plan. EPA has implemented rules that establish the criteria and procedures governing the determination of conformity for all Federal actions in nonattainment and maintenance areas (40 CFR 93.153). Since the area in which Rocky Flats is located is in nonattainment for particulates, carbon monoxide, and ozone, proposed actions at this site have been evaluated, and it has been determined that the total of direct and indirect emissions associated with the proposed actions are below the emissions level for which a conformity determination is required.

4.2.7.2 Savannah River Site

Tables S-21 and S-22 identify the cumulative radiological and chemical impacts at the Savannah River Site resulting from the management of the plutonium residues and scrub alloy addressed in this EIS, other future actions, and current activities.

Table S-21. Savannah River Site Cumulative Radiological Impacts

Impact Category	*Impacts of Existing Operations*[b]	Plutonium Residue and Scrub Alloy Impacts			*Impacts of Other Reasonably Foreseeable Future Actions*[b]	Cumulative Impacts[a]		
		Min.	*Max.*	*Preferred*		*Min.*[c]	*Max.*[d]	*Preferred*[e]
Waste Generation								
High-Level Waste (canisters)[f]	4,600	0	43[g]	5[g]	(h)	4,600	4,643	4,605
Transuranic Waste (cubic meters)	17,100	0	100	10	65,000	82,100	82,200	82,110
Low-Level Waste (cubic meters)	500,000	0	200	42	2,500,000	3,000,000	3,000,000	3,000,000
Low-Level Mixed Waste (cubic meters)	13,000	0	0	0	11,000,000	11,000,000	11,000,000	11,000,000
Saltstone (cubic meters)[i]	627,000	0	2,500	500	(h)	627,000	630,000	628,000
Offsite Population								
Collective Dose, 10 years (person-rem)	68	0	0.38	0.062	686	754	754	754
Number of latent cancer fatalities from collective dose	0.034	0	0.00019	0.000031	0.34	0.37	0.37	0.37
Offsite Maximally Exposed Individual								
Annual Dose, Atmospheric Releases (mrem)	0.14	0	0.0034	0.00057	9.8	9.9	9.9	9.9
Probability of a Latent Cancer Fatality	7.0×10^{-8}	0	1.7×10^{-9}	2.9×10^{-10}	4.9×10^{-6}	5.0×10^{-6}	5.0×10^{-6}	5.0×10^{-6}
Worker Population								
Collective Dose, 10 years (person-rem)	8,400	0	469	76	8,309	16,700	17,200	16,800
Number of latent cancer fatalities from collective dose	3.4	0	0.19	0.030	3.3	6.7	6.9	6.7

[a] *Impacts of existing operations, combined impacts from processing Rocky Flats plutonium residues and scrub alloy, and impacts of other reasonably foreseeable future actions.*
[b] *These are described in the Final Waste Management Programmatic Environmental Impact Statement and in Section 4.25 of the Final EIS.*
[c] *Cumulative impacts, including minimum combined impacts from processing Rocky Flats plutonium residues and scrub alloy.*
[d] *Cumulative impacts, including maximum combined impacts from processing Rocky Flats plutonium residues and scrub alloy.*
[e] *Cumulative impacts, including combined impacts from processing Rocky Flats plutonium residues and scrub alloy under the Preferred Alternative.*
[f] *Each canister is 61 centimeters (2 feet) in diameter, 300 centimeters (10 feet) tall, and contains approximately 1,680 kilograms (3,700 pounds) of high-level waste glass.*
[g] *Material managed as high-level waste.*
[h] *The waste generation due to other reasonably foreseeable future actions (20 years) is included in the column of waste generation due to existing operations.*
[i] *Although saltstone is a low-level waste, it is managed independently from other low-level waste.*

- ***Wastes*** — As shown in Table S-21, existing and future operations at the Savannah River Site will generate large volumes of high-level waste, transuranic waste, low-level waste, low-level mixed waste, and saltstone. Table S-21 also lists the volumes of these wastes that could be generated from the processing of plutonium residues and scrub alloy. The limited processing of plutonium residues and scrub alloy at the Savannah River Site would cause very small increases in the wastes to be managed at this site.

- ***Radiological Impacts*** — As identified in Table S-21, the radioactive releases that would result from processing the Rocky Flats plutonium residues and scrub alloy at the Savannah River Site would not noticeably increase the radiation dose or the associated number of latent fatal cancers in the offsite population. In addition, the radiation dose to the maximally exposed offsite individual would remain below the DOE regulatory limit of 10 mrem per year. The radiation dose to the involved worker population could increase by about 3 percent over the dose from existing operations and other reasonably foreseeable future actions over the 10-year processing period. Doses to individual involved workers would be maintained below the limits, given above in the Rocky Flats cumulative impacts discussion.

- ***Air Quality Impacts*** — The processing of plutonium residues and scrub alloy at the Savannah River Site would involve potential releases of nitrogen dioxide, nitric acid, hydrogen fluoride, and phosphoric acid. The modeled offsite concentrations of these pollutants are presented in Table S-22, along with baseline concentrations and concentrations from other onsite sources that would be operating at the same time as the plutonium residues and scrub alloy processing at SRS.

  Because the total concentrations are lower than the applicable standards, the cumulative impacts of the Proposed Action and the existing baseline should not be of concern with respect to air quality at the Savannah River Site.

Table S-22. Cumulative Air Quality Impacts at the Savannah River Site

Pollutant	*Baseline Concentration ($\mu g/m^3$)*	*Modeled Concentration ($\mu g/m^3$)*	*Concentration from Other Onsite Sources[a] ($\mu g/m^3$)*	*Total Concentration ($\mu g/m^3$)*	*Averaging Time*	*Most Stringent Regulation or Guideline ($\mu g/m^3$)[b]*
Nitrogen Dioxide	8.8	0.039	3.6	12.4	Annual	100
Nitric Acid	50.96	0.65	4.76	56.37	24-Hour	125
Hydrogen Fluoride	0.09	0.00036	0.019	0.11	30-Day	0.8
	0.39	0.0032	0.067	0.46	7-Day	1.6
	1.04	0.0032	0.175	1.22	24-Hour	2.9
	1.99	0.0051	0.327	2.32	12-Hour	3.7
Phosphoric Acid	0.462	0.0016	0.0	0.464	24-Hour	25

[a] *Other approved onsite sources which would be operating at the same time as the plutonium residues and scrub alloy processing at the Savannah River Site.*

[b] *Federal and State standards.*

4.2.7.3 Los Alamos National Laboratory

Table S-23 identifies the cumulative radiological impacts at Los Alamos National Laboratory resulting from the activities addressed in this EIS (limited to processing pyrochemical salts), other future actions, and current activities.

- ***Wastes*** — As shown in Table S-23, existing and future operations at Los Alamos National Laboratory will generate large volumes of transuranic waste, low-level waste, and low-level mixed waste. Table S-23 also lists the volumes of these wastes that could be generated from the processing of pyrochemical salts. The limited processing of plutonium residues at Los Alamos National Laboratory would cause very small increases in the wastes to be managed at this site.

Table S-23. Los Alamos National Laboratory Cumulative Radiological Impacts

Impact Category	Impacts of Existing Operations[b]	Plutonium Residue and Scrub Alloy Impacts			Impacts of Other Reasonably Foreseeable Future Actions[b]	Cumulative Impacts[a]		
		Min.	Max.	Preferred		Min.[c]	Max.[d]	Preferred[e]
Waste Generation								
Transuranic Waste (cubic meters)	10,800	0	600	200	4,400	15,200	15,800	15,400
Low-Level Waste (cubic meters)	150,000	0	1,300	400	325,000	475,000	476,000	475,000
Low-Level Mixed Waste (cubic meters)	2,770	0	0	0	980	3,750	3,750	3,750
Offsite Population								
Collective Dose, 10 years (person-rem)	16	0	0.0024	0.00079	16.9	33	33	33
Number of latent cancer fatalities from collective dose	0.0079	0	1.2×10^{-6}	4.0×10^{-7}	0.0085	0.016	0.016	0.016
Offsite Maximally Exposed Individual								
Annual Dose, Atmospheric Releases (mrem)	7.9	0	0.00080	0.00027	0.37	8.3	8.3	8.3
Probability of a Latent Cancer Fatality	4.0×10^{-6}	0	4.0×10^{-10}	1.4×10^{-10}	1.9×10^{-7}	4.2×10^{-6}	4.2×10^{-6}	4.2×10^{-6}
Worker Population								
Collective Dose, 10 years (person-rem)	4,580	0	160	8.8	763	5,340	5,500	5,350
Number of latent cancer fatalities from collective dose	1.8	0	0.064	0.0035	0.31	2.1	2.2	2.1

[a] *Impacts of existing operations, combined impacts from processing Rocky Flats pyrochemical salts and impacts of other reasonably foreseeable future actions.*

[b] *These are described in the Final Waste Management Programmatic Environmental Impact Statement and in Section 4.25 of the Final EIS.*

[c] *Cumulative impacts, including minimum combined impacts from processing Rocky Flats pyrochemical salts.*

[d] *Cumulative impacts, including maximum combined impacts from processing Rocky Flats pyrochemical salts.*

[e] *Cumulative impacts, including combined impacts from processing Rocky Flats pyrochemical salts under the Preferred Alternative.*

- ***Radiological Impacts*** — As identified in Table S-23, the radioactive releases that would result from processing the Rocky Flats pyrochemical salts in Los Alamos National Laboratory would cause very small increases in the radiation dose or the associated number of latent fatal cancers in the offsite population. In addition, the radiation dose to the maximally exposed offsite individual would remain below the DOE regulatory limit of 10 mrem per year. The radiation dose to the involved worker population could increase by 3 percent over the dose from existing operations and other reasonably foreseeable future actions over the 10-year processing period. Doses to individual involved workers would be maintained below the limits given in the Rocky Flats cumulative impacts discussion.

- ***Air Quality Impacts*** — For the Los Alamos National Laboratory, the emissions of air pollutants from the processing of pyrochemical salts would be very small because only limited processing would take place at this site. In addition, the baseline concentrations of criteria air pollutants and hazardous air pollutants are much smaller than the applicable standards.

4.2.7.4 Intersite Transportation

The cumulative impacts from transportation of plutonium residues and scrub alloy from Rocky Flats to the Savannah River Site and to Los Alamos National Laboratory are identified in Appendix E of the EIS. Since likely transportation routes cross about nine states, cumulative impacts are computed on a national basis. Occupational radiation exposure to transportation workers and exposure to the public would each increase by about 0.01 percent from the estimated cumulative exposure between 1943 and 2035 and would represent an estimated 0.1 percent of the cumulative exposure over the 10-year processing period. An additional traffic fatality is not expected and the incremental increase in traffic fatalities would be less than 0.0001 percent per year.